TRESKY

Documentation

T-SuiteM

Software V2.0

TRESKY

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T-SUITE v2
DIE BONDING SOFTWARE

T-SuiteM v2.0 Documentation

This manual describes the general operation of Tresky's "T-Suite Manual-v2 **(TSM)**" die bonder software. It is an integral part of a technical training course, not a complete documentary reference manual. The information disclosed herein is the property of Dr. TRESKY AG/Switzerland. TRESKY reserves all proprietary, design, manufacturing, reproduction use and sales rights thereto, and to any article or process utilizing such information, expect to the extend that rights are expressly granted to others
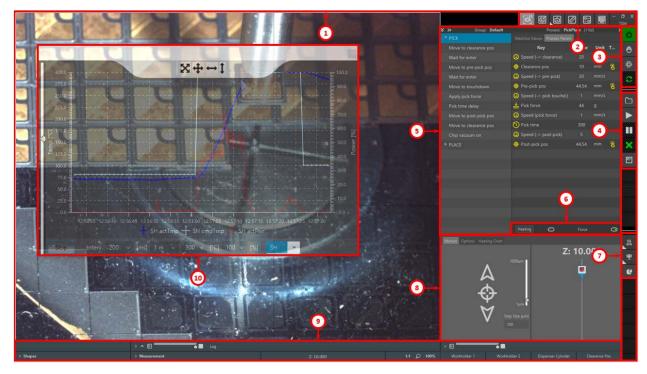
This equipment is designed as universal platform for various pick and place technologies/processes. According to customer process-requirements, additional options may be necessary for this equipment. For these options, Tresky keeps the right to use/modify certain "standard" functions from the basic machine and therefore must not correspond with the description in this manual or in conflict with others. Some software may differ from its retail version (if available), and may not include user manuals or all program functionality.

1 User Interface

1.1 General

The **TSM** application was designed in a modern "dark theme" look-and-feel. All UI-controls feature a "flat" design. State-changes of buttons *(e.g. "pressed", "unpressed")* are indicated by changes in the background color *(e.g. dark gray light gray)*. The main user interface incorporates a **main view** *(displaying the picture of the currently configured main camera)* and several supplementary views *(providing additional functionality; e.g. logs, shapes view, measurements ,,,)*. These were designed for a maximum of usability, user friendliness and flexibility. Therefore, each supplementary view can be expanded/collapsed and additionally changed in its opacity as described below.

1.1.1 Main View

	Element	Description
1	**Main View**	Displays the video image of the main camera. Acts as container for all other views.
2	**Main Toolbar**	Contains "main" functions/buttons for camera control and other features. Includes UI controls for window handling.

> ✓ **Window Handling**
>
> You can resize the **T-SuiteM** application window normally in its width and height at each four corners. For moving the window around, grab it at the "**TSM**" label *(red marked area below)*.
>
>

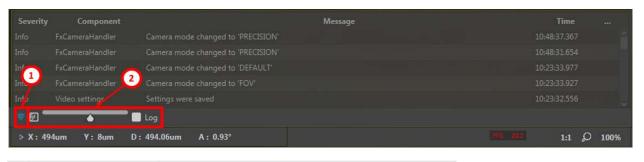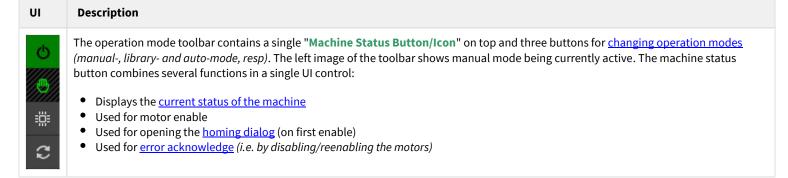|	Element	Description
3	**Operation Mode Toolbar**	Contains buttons for operation mode selection *(manual-, library-, auto-mode)* and an indicator for the machine status which also acts as button for enabling the Z-axis.
4	**Context Toolbar**	Shows "context"-dependent functions/buttons *(e.g. Start/Stop in auto-mode)*.
5	**Process View**	Shows process related information *(sequence of execution, process parameters)*.
6	**Process Options**	Contains process option switches *(e.g. force control on/off)*.
7	**Heating Toolbar**	Contains buttons for manually controlling the individual heating units.
8	**Support View**	Incorporates several tabs with different supporting functionality *(e.g. Motion Joystick, Auxiliary Camera, Options, Beam Splitter ...)*.
9	**Statusbar**	Displays status information *(e.g. measurement, zoom ...)*. Contains supporting views like the Log View.
10	**Heating Chart**	Shows the Heating Chart in "undocked" state.

> ⊘ **Undocked Heating Diagram**
>
> The opacity of the undocked window can be adjusted by the slider in the far left part of the window.
>
> Using the heating chart in undocked state with reduced opacity allows it to view the main camera picture and monitoring the heating temperature and power at the same time.
>
> Closing the undocked heating chart window via "X" button brings the chart back to the support view panel.

1.1.2 View Visibility
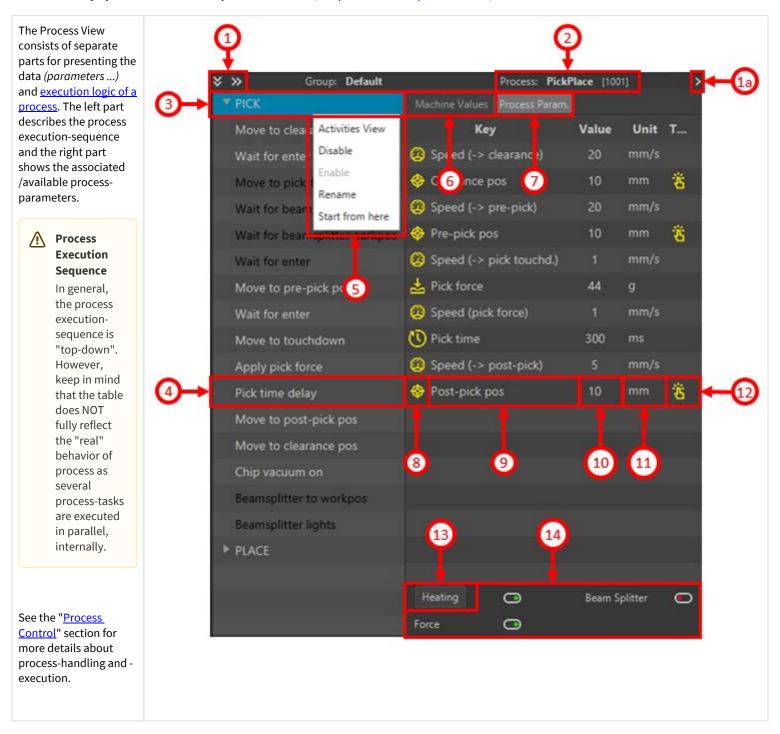
1	**Expand/Collapse View**	Allows the individual view to be expanded/collapsed.
2	**Opacity Slider**	Allows the individual view's transparency to be adjusted.

1.2 Operation Mode Toolbar

UI	Description
	The operation mode toolbar contains a single "**Machine Status Button/Icon**" on top and three buttons for changing operation modes *(manual-, library- and auto-mode, resp)*. The left image of the toolbar shows manual mode being currently active. The machine status button combines several functions in a single UI control: • Displays the current status of the machine • Used for motor enable • Used for opening the homing dialog (on first enable) • Used for error acknowledge *(i.e. by disabling/reenabling the motors)*

1.3 Process View

The aim of the "Process View" is to support the user with additional information of the given process *(process sequence, parameter values…)*. The view is **automatically opened the first time a process is loaded** *(independent of the operation mode)*.

The Process View consists of separate parts for presenting the data *(parameters …)* and execution logic of a process. The left part describes the process execution-sequence and the right part shows the associated /available process-parameters.

⚠ **Process Execution Sequence**
In general, the process execution-sequence is "top-down". However, keep in mind that the table does NOT fully reflect the "real" behavior of process as several process-tasks are executed in parallel, internally.

See the "Process Control" section for more details about process-handling and -execution.

	Description
1	**Minimize/Maximize/Collapse**
1a	Depending on personal preference, the whole Process View can be slightly reduced in height or completely collapsed to the right **(1)**. Furthermore, the process parameters table can be collapsed to the right separately **(1a)**.
2	**Process Name and Group** Indicates the name and associated (process-)group of the currently active process.
3	**Process Activity Node** An "Activity" is considered a "high-level" execution node. That is, it contains/represents a collection of steps of process-logic execution.
4	**Process Task Node** A "Task" is considered a "low-level" execution node. That is, it represents a single step of process-logic execution.
5	**Context Menu** The context menu is opened via right mouse button. It provides different, context-related commands like switching process view presentation modes *(tree view ...)* or options for manipulating the process sequence *(enabling/disabling nodes, "Start from here" ...)*.
6	**Machine Values Tab**
7	**Process Parameters Tab**
8	**Process Parameter Type** *(position, speed, time, force ...)*
9	**Process Parameter Description**
10	**Process Parameter Value** Double click to edit.
11	**Process Parameter Unit**
12	**Process Parameter Teaching** Teaches the given position parameter. There are two different parameter teach methods available: ■ **Single teach** *(left mouse button)*: Overwrites the selected parameter with the actual position of the Z-axis on the current activity only. ■ **Multi teach** *(right mouse button)*: Overwrites the selected parameter with the actual position of the Z-axis on all activities of the current process.
13	**Heating Configuration** Opens the heating configuration dialog. Only available if the "Heating Control" machine-option is installed/enabled.
14	**Process Options** Process-options provide a possibility for adjusting the process-logic. Each process-activity can have different process-options enabled / disabled, individually. That is, the same option can be enabled for one activity and disabled for another. Click the given button to toggle enable /disabled state of the respective option.
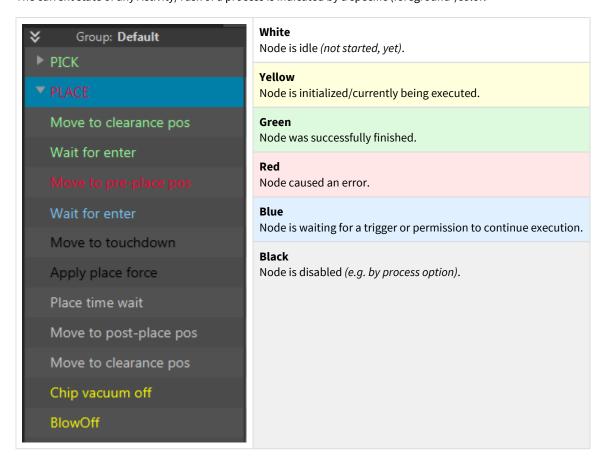
1.3.1 Process Presentation

The process execution sequence can be visualized/presented in three different forms. To switch from one presentation to another, open the context-menu on a node *(Activity/Task)* by right-clicking it and choose the desired action *(see the pictures below)*.

Tree View	
	Shows both, Activities and Tasks in a tree-like structure. → get back to "Activities View" via [Process View context menu](#)
Activitites View	
	Shows the Activities (high-level elements) but hides the details (Tasks). → switch to "Task View" by double-clicking an Activity → get back to "Tree View" via [Process View context menu](#)
Task View	
	Shows only the Tasks of the selected Activity. → get back to "Activities View" via [Process View context menu](#)

1.3.2 Process Execution-States

The current state of any Activity/Task of a process is indicated by a specific (foreground-)color.

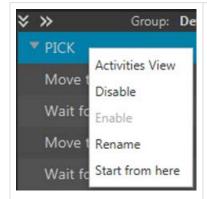|	
Group: Default ▶ PICK ▼ PLACE 　Move to clearance pos 　Wait for enter 　Move to pre-place pos 　Wait for enter 　Move to touchdown 　Apply place force 　Place time wait 　Move to post-place pos 　Move to clearance pos 　Chip vacuum off 　BlowOff	**White** Node is idle *(not started, yet)*. **Yellow** Node is initialized/currently being executed. **Green** Node was successfully finished. **Red** Node caused an error. **Blue** Node is waiting for a trigger or permission to continue execution. **Black** Node is disabled *(e.g. by process option)*.

1.3.3 Process Sequence Manipulation

The sequence of auto-mode processes can be influenced by disabling individual nodes *(e.g. single tasks or whole activities)* or by choosing an alternative entry point for process start. The <u>Process View</u> context menu *(shown below)* is opened by clicking with the right mouse button on a process node *(works only for auto-mode processes)*.

> ⚠ **Command availability**
>
> Keep in mind that the availability of the individual commands <u>depends on the actual state of the process</u>. That is, **some commands are disabled when a process is active** *(for safety reasons)*.

Disable

Disables the selected node for execution. Command is not available for a running process.

> ⚠ Disabling a task node disables only the selected task. **Disabling an activity node disables all tasks** of the selected activity.

> ⊘ Note that **disabling a single task can lead to the process getting stuck** because **inter-dependencies between tasks exist** *(i.e. one task may be waiting for or depending on the execution of another task)*. These inter-dependencies, however, can not be seen in the Process View and might not be obvious to the users. If a process gets stuck after disabling a specific node, try to re-run the process again with the node enabled.

Enable

Enables the selected node for execution. Command is not available for a running process.

> ⚠ Enabling a task node enables only the selected task. **Enabling an activity node enables all tasks** of the selected activity.

Rename

Rename an activity. Command is not available for a running process.

This feature is especially useful if the same activity type (e.g. Pick) is used within a single process *(e.g. Pick-1, Place-1, Pick-2, Place-2 ...)*.

Start from here

Sets the process execution entry point. Command is only available for activity nodes.

> ⚠ Choosing a specific activity node as entry point *(activity node)* **automatically cancels the current process and restarts it**, starting with the selected.
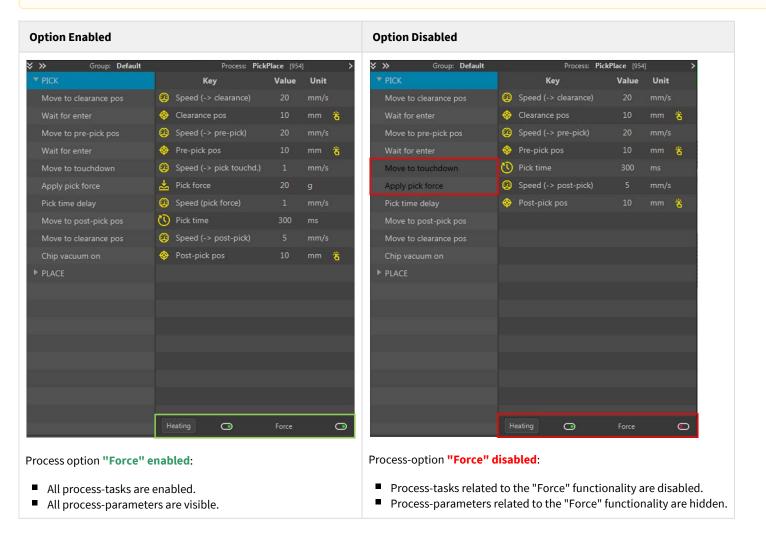
1.3.4 Process Options

Depending on the specific activity *(Pick, Place ...)*, the user has the possibility of influencing/adjusting the processlogic by enabling or disabling different "process-options" *(that is, the process-sequence is adjusted, accordingly)*. Process-parameters of disabled tasks are automatically hidden.

> ⚠ **Adjusting Process Options**
>
> Keep in mind that process-options can NOT be adjusted for a started/running process. The process must be cancelled before the option-switches can be manipulated.

Option Enabled	Option Disabled
Process option **"Force" enabled**: ■ All process-tasks are enabled. ■ All process-parameters are visible.	Process-option **"Force" disabled**: ■ Process-tasks related to the "Force" functionality are disabled. ■ Process-parameters related to the "Force" functionality are hidden.
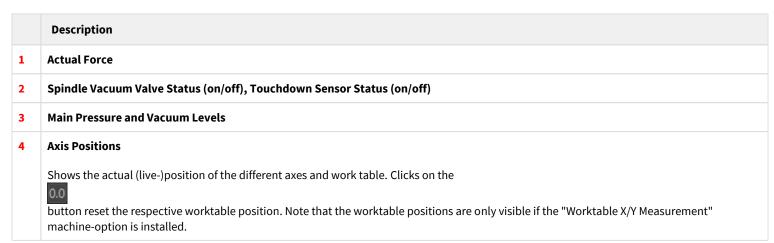
1.4 Support View

1.4.1 Common Functions

Workholder 1	Workholder 2	Dispenser Cylinder	Clearence Pos.
Work holder 1 vacuum on/off	Work holder 2 vacuum on/off	Dispenser mechanics up/down	Move Z-axis to "Clearance position"

1.4.2 Machine Values

	Description
1	**Actual Force**
2	**Spindle Vacuum Valve Status (on/off), Touchdown Sensor Status (on/off)**
3	**Main Pressure and Vacuum Levels**
4	**Axis Positions** Shows the actual (live-)position of the different axes and work table. Clicks on the `0.0` button reset the respective worktable position. Note that the worktable positions are only visible if the "Worktable X/Y Measurement" machine-option is installed.

| 5	**Worktable Center Calculations**
	Allows calculating the center of a rectangle or circle by means of "2P" (rectangle) and "3P" center calculation modes.
	Clicking on the teach
	button for the given point stores the actual X- and Y coordinates for the actual calculation. Calculation results are shown when clicking on the last teach
	button *(P2 or P3, according to the calculation mode)*. Note that the panel is only visible if the "Worktable X/Y Measurement" machine-option is installed.
6	**Heating**
	Shows the status of the individual heating units *(current temperature, current power, target temperature, controller state)*.

1.4.3 Auxiliary Camera View
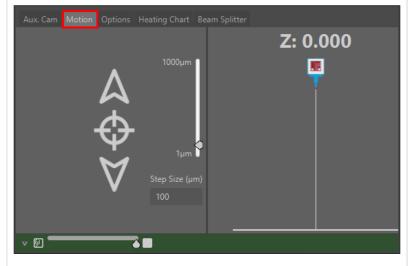
ⓘ The auxiliary camera view is only present if at least 2 cameras are installed/enabeld.

Switching a cameras between main- and auxiliary view is possible with the "Swap cameras" toolbar button.

See the "TSuite-Vision" documentation part for details.

1.4.4 Motion Joystick

Joystick movements with the Z-motor are only possible when the UI joystick panel is enabled. The movements can be performed either via UI buttons *(joystick panel shown on the left)* or via "UP/DOWN" control panel buttons.

In general, the motion joystick can be operated in two different modes:

- **Step Mode**

In "Step mode", the Z-axis performs a single step of given step size into the chosen direction. The step size can be adjusted roughly via slider or by setting a very precise step width with the text field.

- **Continous Mode**

In "Continous mode", the axis performs a continous movement into the chosen direction **as long as the respective button is pressed**.
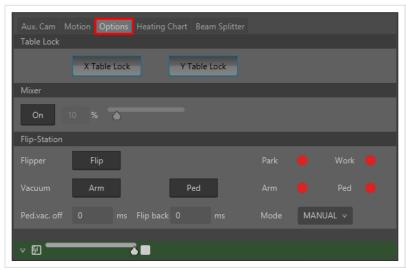
⚠ **Continous Mode**
Continous mode **gets automatically active if the respective joystick button is held for a minimum of 300ms**. That is, with the first trigger of the button, the Z-axis performs one single step into the desired direction ("Step mode"). If the button is not released again within 300ms, the motor will start moving continuously into the given direction ("Continous mode"). Releasing the button stops the axis immediately.

⚠ **Joystick Safety**
Please note that **the joystick operations are automatically disabled in certain situations for safety reasons** *(e.g. when the Z-axis is already moving)*. Furthermore, joystick operation is only possible after the machine was successfully homed/initialized.

1.4.5 Optional functions

Depending on the machine configuration *(i.e. which options are installed)*, this tab may contain different functionality like work table X/Y locking, adhesive mixer control or flip station handling.

> ⚠️ **Safety**
>
> Care has to be taken when performing these manual functions as some of them may "override" automatic control that is performed by a running process.

Table Lock	Allows the locking/unlocking of the work table in X- and Y-direction. Depending on the machine configuration, the function applies to both directions at the same time or to each direction individually.
Stamping (Mixer)	Allows operating the adhesive mixer manually. ⓘ **Safety** Note that this function overrides the mixer speed set by a running process.

Flip Station	Allows operating the Flip Station manually.
	
	 "Logic" tab
	
	 • Button "Flip": performs the *(half/full)* flip (mode dependent)
	 • Button (Vacuum) "Arm": turns the flipper arm vacuum on/off
	 • Button (Vacuum) "Ped": turns the pedestal vacuum on/off
	 • Icon "Park": flipper arm park position sensor state
	 • Icon "Work": flipper arm work position sensor state
	 • Icon "Arm": arm vacuum valve state
	 • Icon "Ped": pedestal vacuum valve state
	
	 "Settings" tab
	
	 • "Mode": select mode
	      • "Auto": the "Flip" button causes a full flip cycle *(park pos → work pos → park pos)*
	      • "Manual": the "Flip" button causes a half-flip only *(park pos → work pos or vice versa)*
	 • "Ped. vac. off" delay between "flipper arm in work pos" and "pedestal vacuum off"
	 • "Flip back": delay between "pedestal vacuum off" and "flip back to work pos"

1.4.6 Heating chart

Shows a diagram visualizing actual-/commanded temperature and power-output over time for the individual heating units.
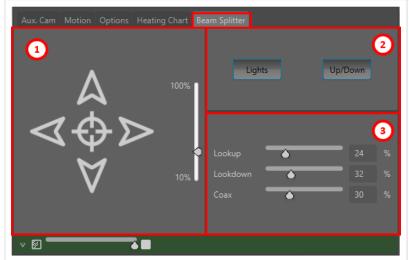
✓ **Heating Chart Undocking**

The heating diagram can be "undocked" into its own window by clicking the "Heating Chart" tab *(marked red on the left picture)* with the right mouse button and selecting "Undock" from the context menu.

Using the heating chart in undocked state with reduced opacity allows it to view the main camera picture and monitoring the heating temperature and power at the same time *(see the "Main View" section for an example of the undocked heating diagram window)*.

Closing the undocked heating chart window via "X" button brings the chart back to the support view panel.

1.4.7 Beam splitter

Allows controlling beam splitter related functionality manually.

(1) Camera picture AOI-shift *(see the TSuite-Vision documentation for details)*

(2) Switch beam splitter cylinder and lights

(3) Control the intensity of the beam splitter lights
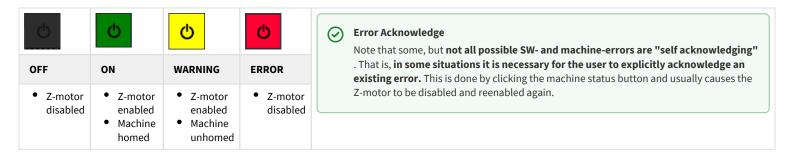
⚠ **Safety**

Care has to be taken when operating the beam splitter cylinder manually as it "overrides" automatic control that is performed by a running process.

2 Machine Safety

2.1 Machine Status

The general status of the machine is indicated by the first button/icon of the operation mode toolbar. Depending on the actual state of the machine, the icon's color will change, accordingly. Furthermore, any warnings/errors are usually made visible by a respective entry in the log view.

OFF	ON	WARNING	ERROR
⏻	⏻	⏻	⏻
• Z-motor disabled	• Z-motor enabled • Machine homed	• Z-motor enabled • Machine unhomed	• Z-motor disabled

> ✓ **Error Acknowledge**
>
> Note that some, but **not all possible SW- and machine-errors are "self acknowledging"**. That is, **in some situations it is necessary for the user to explicitly acknowledge an existing error.** This is done by clicking the machine status button and usually causes the Z-motor to be disabled and reenabled again.

2.2 Connection Check

For guaranteeing safe operation, the **TSM** software needs a robust and stable (Ethernet-)connection to the main hardware controller all the time. Therefore, the connection is permanently monitored in the background by an internal "connection watchdog".
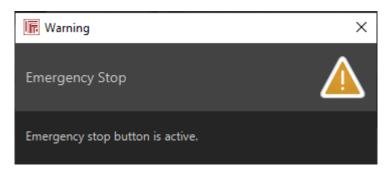
> ⚠ **Connection Problems**
>
> In case of connection problems, the watchdog reacts by **immediately (emergency-)stopping and disabling all motorized axes**. The machine status will change to "ERROR" and a respective error message will be printed to the log. Please note **that no further operation with the TSM software is possible in such a situation**. That is, for safety reasons **the TSM application needs to be shutdown and restarted**. Check that the hardware controller is powered properly and the Ethernet connection to the controller present. Try to reboot the whole system and check if the problems still exist.

2.3 Emergency Stop

TSuiteM monitors the emergency stop button all the time. In case the button is triggered, motor power is cut off and a respective warning message will appear on the screen.
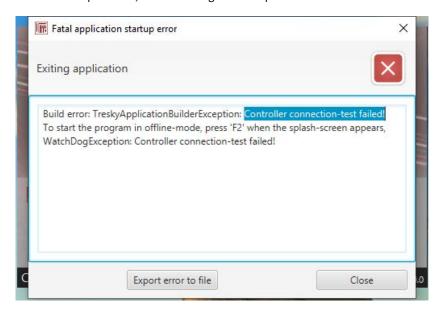

> ⚠ Note that the dialog will close automatically as soon as the emergency stop is released again. That is, for safety reasons it is not possible to manually close the warning dialog.

2.4 Offline Mode

As already mentioned above, **the connection to the hardware controller is permanently monitored from the moment of application start**. In case of connection problems, an error dialog with a respective notification will be shown.

> ✓ **Offline Mode**
>
> Note that it is always possible to start the **TSM** software in "offline mode". This mode can be activated by pressing the 'F2' key during application startup, **immediately after the splash screen appears**. It must be pointed out, however, that **the "offline"-mode has severe restrictions** with respect to general operation *(e.g. no Z-axis movements and I/O control possible)*.

2.5 Homing

UI	Description
Machine homing required ⊠ Homing requirements Main pressure ✓ X/Y-table park-pos Y ✓ ◯ 0% Start homing · Stop	Whenever the machine is powered up/restarted, the hardware controller must first perform a "homing/initialization run". This brings the Z-motor in a well-defined position *(by searching for the homing limit switch and init marker, resp.)* and prepares the system for operation. ✅ **Homing Start** In order to open the homing dialog *(shown on the left)*, click on the "Machine Status Button/Icon" on the <u>operation mode toolbar</u>. If all homing requirements are met, the "Start homing" button will be enabled for starting the homing run. Alternatively, you can push the "REF/SET" button on the console *(note that this only works if the homing dialog is already open)*.

2.5.1 Homing Requirements

⚠ **Homing Requirements**

In general, it is not possible to operate the machine/motor in unhomed state. **Homing itself can only be started if the respective homing requirements are fully met:**

(1) Z-axis handle

It is critical that the Z-axis handle is put into its uppermost position before starting the homing run!

Usually the handle is dragged to the top automatically. However, depending on the counterweight adjustment, <u>a small gap might still exist which needs to be closed by the user by slightly pushing the handle to the top</u>.

Note that, if the homing run is performed with the handle in an incorrect position, a permanent Z-axis position offset might result which can lead to wrong Z-axis positions or unexpected limit switch errors, making a new homing run necessary *(see "Z-Axis Limit Switch Monitoring" below)*.

(2) Further requirements

Depending on the given circumstances *(machine configuration and installed options)*, the homing requirements may vary. If conditions change after homing start but before the initialization was finished, all movements will immediately be stopped. A new homing run can be started not before all homing conditions are fulfilled again.
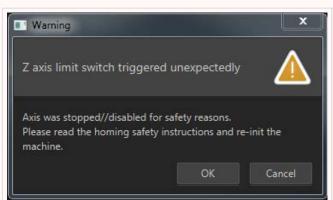
Note that, once homing was successful, the procedure doesn't need to be executed again unless the hardware controller is rebooted or the *(upper)* limit switch triggers unexpectedly *(see explanation below)*. That is, even if the **TSM** software is shutdown/restarted, <u>a new homing will only be required if the power to the hardware controller is cut off</u> *(e.g. by shutting down the whole machine)*.

2.5.2 Z-Axis Limit Switch Monitoring

⚠ **Z Axis Limit Switch Monitoring**

The Z-axis *(upper)* limit switch is being observed for unexpected triggering as additional safety measure. This is necessary to prevent the Z-axis from moving beyond the limit switch and possibly into the mech. limit.
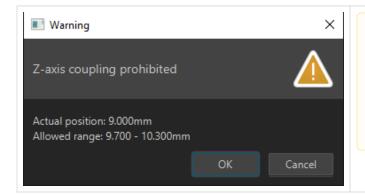
Warning ✕ ⚠ Z axis limit switch triggered unexpectedly Axis was stopped//disabled for safety reasons. Please read the homing safety instructions and re-init the machine. OK · Cancel	The limit switch monitoring is only active AFTER successful homing was performed once *(that is, the monitoring gets active directly after the homing run finished)*. In case the limit switch is triggered unexpectedly, the Z-axis is stopped/disabled and a respective warning message issued *(left picture)*. If this happens, **a new machine homing run needs to be initiated by the user due to safety reasons** for being able to operate the machine again!

2.6 Z-Axis Coupling

The software contains a **Z-axis coupling safety functionality** which checks the decoupling- and recoupling positions. Whenever the Z-axis is decoupled, the software remembers the actual Z-axis position *(referred to as "decoupling position")*. On the next recoupling, the new actual position *(referred to as "recoupling position")* is compared against the (previous) "decoupling position".

⚠ Recoupling Warning

Note that **the "recoupling position" must lie within the range of +/- 0.3mm of the previous "decoupling position" for recoupling to succeed**. If the check fails *(i.e. the "recoupling position" is out of the allowed range)*, a respective warning is shown on the screen *(see picture to the left)*. Coupling then has to be repeated until the position window is reached.

2.7 Touchdown Sensor

For avoiding mechanical damage to the head, tool and other related components, the touchdown sensor is monitored all the time for any forbidden/unexpected state change. By default *(i.e. no touchdown)*, the sensor state is "high/enabled", whereas in touchdown, the sensor state changes to "low/disabled".

In general, a trigger to "low/disabled" state of the sensor **is only allowed in certain situations/circumstances**:

- When **searching for the touchdown** position *(process execution)*
- When **applying force** *(process execution)*
- If the Z-axis is **in standstill**
- If the Z-axis is **moving upwards** *(i.e. with any negative speed)*
- If the Z-axis is **moving downwards/positive at reduced speed** *(e.g. < 5.0 mm/sec)*

⚠ Touchdown Sensor Error

In case the sensor triggers to "low/disabled" state in a different situation than the ones listed above, **a touchdown error is reported**. As a safety measure, **the Z-axis will automatically be stopped and disabled**. In such a situation, **the error must be acknowledged by the user explicitly** by clicking the machine status button *(disables/reenables the Z-motor)*.

2.8 Options Safety

Depending on the given machine configuration and installed options, additional safety functionality might be active.

2.8.1 Beam Splitter

For avoiding mechanical damage to the bonding arm/head, tool and other related components, the beam splitter X-position sensor is monitored all the time for any forbidden/unwanted state change. In general, beam splitter X-movements are only allowed if the Z-axis is in standstill.

> ⚠️ **Beamsplitter Error**
>
> In case the beam splitter X-sensor changes its state while the Z-axis is moving, **a respective error is reported**. As a safety measure, **the Z-axis will automatically be stopped and disabled**. In such a situation, **the error must be acknowledged by the user explicitly** by clicking the machine status button *(disables/re-enables the motors)*.

2.8.2 Work Table

> ⚠️ **Beam Splitter & Wafer/Die Ejector**
>
> Note that, if "Beam Splitter" & "Die Ejector" options are both activated in a process, **Z-axis movements are only allowed if the worktable is in its park position**. This safety measure is necessary to avoid collisions of the Z-axis/beam splitter mechanics with the work table.
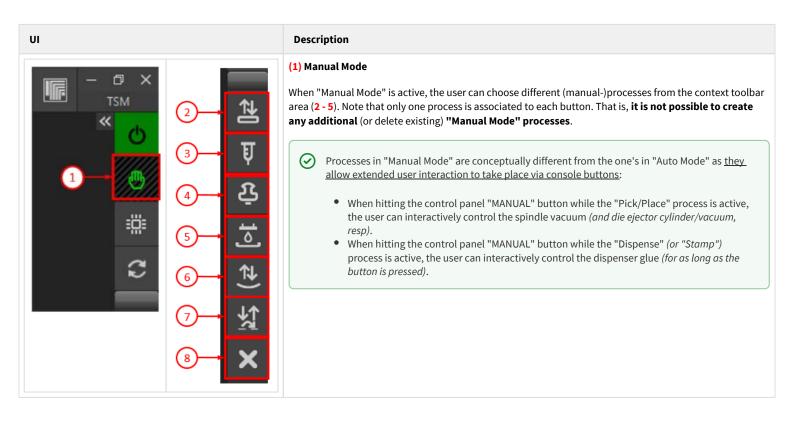
3 Operation Modes

TSM features different operation modes which can be chosen from by clicking the respective buttons of the "Operation Mode Toolbar". The currently active mode is indicated by highlighting the respective button *(e.g. manual mode being currently active in the image below)*.

Mode	Button/Icon
Manual	
Library	
Auto	

3.1 Manual Mode

"Manual Mode" is indicated with green color in parts of the UI.

UI	Description
	(1) Manual Mode When "Manual Mode" is active, the user can choose different (manual-)processes from the context toolbar area (**2 - 5**). Note that only one process is associated to each button. That is, **it is not possible to create any additional** (or delete existing) **"Manual Mode" processes**. ✓ Processes in "Manual Mode" are conceptually different from the one's in "Auto Mode" as they allow extended user interaction to take place via console buttons: • When hitting the control panel "MANUAL" button while the "Pick/Place" process is active, the user can interactively control the spindle vacuum *(and die ejector cylinder/vacuum, resp)*. • When hitting the control panel "MANUAL" button while the "Dispense" *(or "Stamp")* process is active, the user can interactively control the dispenser glue *(for as long as the button is pressed)*.

(2) Pick & Place Process: Loads and starts the standard "Pick & Place" manual process. (quick access)

(3) Dispense Process: Loads and starts the "Dispense" manual process.

(4) Stamp Process: Loads and starts the "Stamp" manual process.

(5) Flux Process: Loads and starts the "Flux" manual process.

(6) Preform Pick & Place Process: This button loads and starts the "Preform Pick & Place" manual process.

(7) Pick & Flip & Place Process: Loads and starts the "Flipping" manual process *(Pick → Place on flipper → Repick from flipper → Place).*

(8) Cancel Process: Cancels the currently active manual process.

⚠️ **Cancelling Processes in Manual Mode**

Whenever the "Manual Mode" button is pressed, any ongoing process is cancelled/reset. Furthermore, with the selection of a new process *(e.g. "Pick/Place" → "Dispense" or vice versa)*, the existing process is cancelled and the newly selected process started.

⚠️ **Process Availability**

Note that the available processes in manual mode depend on the given machine-configuration.

3.1.1 Control Panel

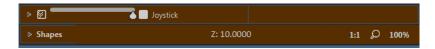|			
Joystick up Move Z-axis up		**Homing** Initiate Z-axis homing sequence *(homing dialog must be open)*	
Z lock Couple/decouple Z-axis mechanics		**Manual Control** Control spindle (pick/place-)vacuum or dispenser pressure manually	
Joystick down Move Z-axis down		**Enter** Used for process control *(e.g. acknowledge)*	

Some console buttons ("Enter", "Manual" ...) inherit special functions in Manual mode (differing from the functions in Auto mode).
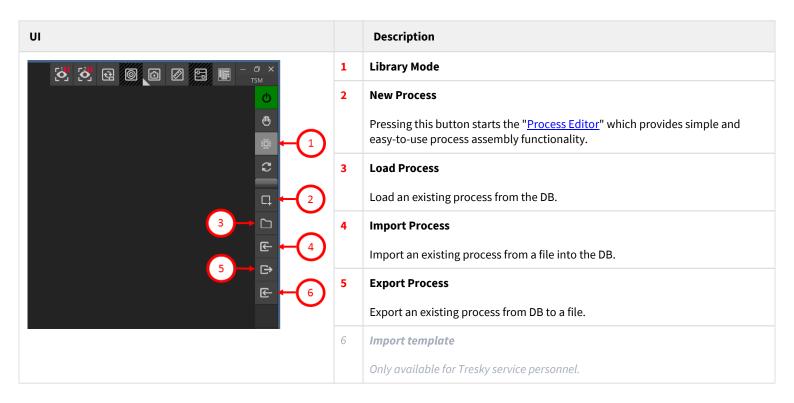
| Button	Description
Enter	Manual Mode & Low Force & - Pick-Place - Pick-Flip-Place - Stamp The "Enter" button can be used for explicitly/manually **controlling the Low Force stabilization**.
Manual	Manual Mode & - Pick-Place - Pick-Flip-Place The "Manual" button can be used for explicitly/manually **controlling spindle-vacuum and wafer ejector-cylinder and -vacuum** *(the latter of which is only controllable if option "Die Ejector" is installed)*. The full logic sequence is as follows: 1. Spindle-vacuum ON & die ejector needle UP & die ejector vacuum ON 2. Die ejector needle DOWN & die ejector vacuum OFF 3. Spindle-vacuum OFF If spindle-vacuum is OFF at the time the "Manual" button is pressed the 1st time, the logic starts at (1). If spindle-vacuum is ON at the time the "Manual" button is pressed the 1st time, the logic starts at (2). If the "Die Ejector" option is not installed, step (2) is skipped.
	Manual Mode & - Dispense - Stamp The "Manual" button can be used for explicitly/manually **controlling the dispenser glue** *(on/off)*.
	Library Mode The "Manual" button can be used for explicitly/manually **controlling spindle-vacuum** *(on/off)*. This feature can prove useful when teaching/setting up a new process.

3.2 Library Mode
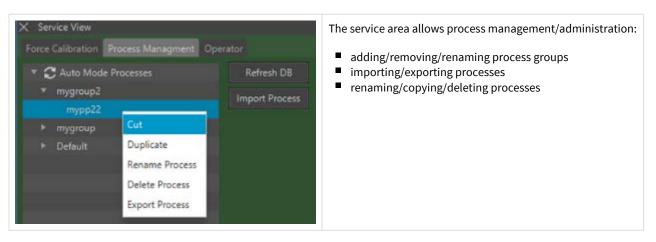
3.2.1 General

The purpose of the "Library Mode" is for the user to be able to manage/administer (Auto Mode-)processes. It is indicated with brown color in parts of the UI.
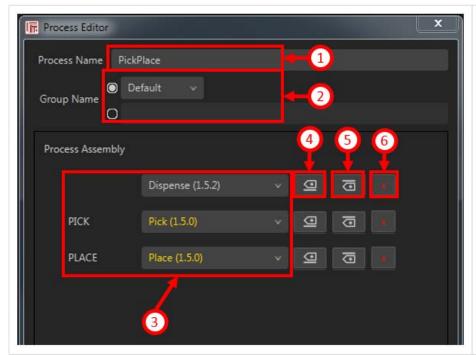

UI		Description
	1	**Library Mode**
	2	**New Process**
		Pressing this button starts the "Process Editor" which provides simple and easy-to-use process assembly functionality.
	3	**Load Process**
		Load an existing process from the DB.
	4	**Import Process**
		Import an existing process from a file into the DB.
	5	**Export Process**
		Export an existing process from DB to a file.
	6	*Import template*
		Only available for Tresky service personnel.

3.2.2 Process Administration

The service area allows process management/administration:

- adding/removing/renaming process groups
- importing/exporting processes
- renaming/copying/deleting processes

3.2.3 Process (Assembly) Editor

The "Process Editor" provides simple, graphical and easy-to-use assembling functionality for defining the structure of a new process or changing existing processes.

A process can consist of an arbitrary number and sequence of "Activities" which represent the desired process execution logic. Furthermore, each process is associated an own set of data *(process parameters)*.

Note that processes created with the "Process Editor" can only be executed in "Auto Mode". Also note that, when loading an existing process into the Process Editor, **the type of former existing activities** (shown in yellow font) **can not be changed**.

Each activitiy in the assembly list is shown by its type, followed by a version number (which might increase with future software versions).

ⓘ A process is composed of individual "Activities". An "Activity" is a collection/sequence of tasks which are executed to fullfil the given logic *(e. g. axis movements, controlling I/Os, delays ...)*. Activities can be assembled by the user in arbitrary order and are NOT automatically checked for logical plausability *(e.g. "Place" may be used before "Pick")*.

|	Description
1	**Process Name** Valid process names may only include **alphanumerical characters and underscore.** > ⊙ **Process Names** > **Process names must be unique**. That is, <u>no two processes with the same name can exist</u>. Invalid/duplicate process names are indicated by a red background color of the respective textfield and a validation error.
2	**Process Group** *(from existing group names)* Select an existing group or create a new one. Each process needs to be assigned to a "process group" *(where the standard group is "Default")*. The "process group" mechanism can be used for "categorizing and/or administering" processes *(in a similar fashion like file browsers)*. However, note that **"group nesting" is NOT possible** *(that is, a group can not have sub-groups)*. Valid group names may only include **alphanumerical characters and underscore.** > ⊙ **Group Names** > **Group names must be unique**. That is, <u>no two process groups with the same name can exist</u>. Invalid/duplicate group names are indicated by a red background color of the respective textfield and a validation error.
4	**Add a new Activity before** Adds a new activity <u>before the selected row</u>. Depending on the given machine configuration *(available options ...)*, the user can choose from several different Activity types.
5	**Add a new Activity after** Adds a new activity <u>after the selected row</u>.
6	**Delete the Activity** Note that this action **can not be undone.**
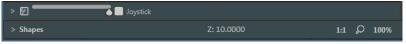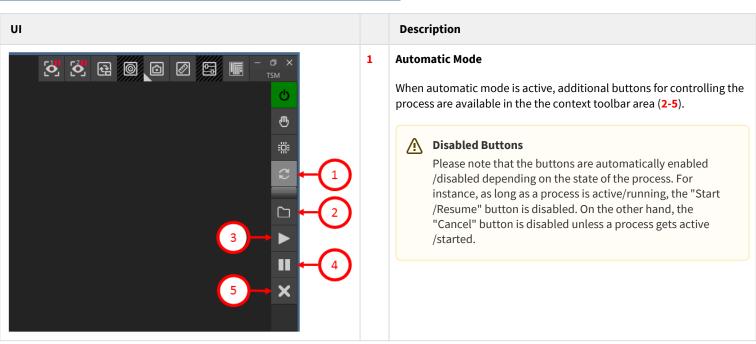
> ⚠ **Created Processes**
> Please note that **new processes are created for "Auto Mode", only** *(and not for "Manual Mode")*. That is, in "Manual Mode" only the pre-defined/pre-existing processes are available *(selectable via buttons of the "Manual Mode" context toolbar)*.

3.3 Automatic Mode

The main purpose of the "Automatic Mode" is for the user to be able to execute specifically assembled and customized processes from the library. The mode is indicated with blue color in parts of the UI.

UI	Description
	1 **Automatic Mode** When automatic mode is active, additional buttons for controlling the process are available in the the context toolbar area (**2-5**). ⚠ **Disabled Buttons** Please note that the buttons are automatically enabled /disabled depending on the state of the process. For instance, as long as a process is active/running, the "Start /Resume" button is disabled. On the other hand, the "Cancel" button is disabled unless a process gets active /started.

2	**Load a Process** This button opens the process-loading dialog for selection of a new process to be loaded/executed.
3	**Start/Resume a Process** This button starts a previously loaded process. When a running process was paused, this button resumes the same process again.
4	**Pause a Process** This button pauses the actual process. Other than a cancelled process, a paused process can be resumed by a click on the "Start/Resume" button again.
5	**Cancel a Process** This button cancels any active process. Please note that a cancelled process needs to be restarted again from the beginning *(other than a paused process, which can be resumed at the position where it previously stopped)*.

4 Process Control

4.1 Process Structure

In general, a process consists of **data** *(process parameters)* and a specific **execution logic**. The left part of the "Process View" shows the execution logic of the currently active process, whereas the right part presents the actual values of the associated process parameters. The process logic itself is determined by the "**Activity-**" and "**Task-**" nodes a process is composed of. This composition is done via "Process Editor".

4.2 Process Activities

The table below shows an overview of all available/possible process-activities of the **TSM** application.

Activity	Description
Pick	Pick a chip (default logic)
Place	Place a chip (default logic)
Dispense	Apply glue via dispenser mechanics/syringe
Stamp	Apply glue via stamp tool (using pick/place spindle) and adhesive mixer
Flux	Apply glue via picked chip (using pick/place spindle) and adhesive mixer
MeasureTouchdown	Needed for "Bondline Thickness" pick & place.
PreformPick	Pick a chip via "Preform" mechanics/tool
PreformPlace	Place a chip via "Preform" mechanics/tool

> ⚠ **Process Options Availability**
> Type and number of effectively available process-activities depends on the given machine-configuration *(installed HW-/SW-options …)*.

4.3 Process Sequence Manipulation

The sequence of auto-mode processes can be altered by disabling individual nodes *(single tasks or whole activities)* or choosing an alternative entry point for process start. For details, see the description of the respective functionality in the process view section.

4.4 Process Options

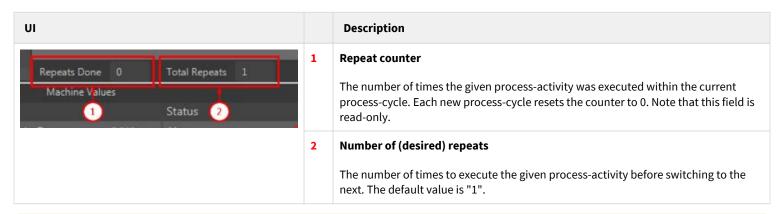The table below shows an overview of all process-options of the **TSM** application.

> ⚠️ **Process Options Availability**
>
> Please keep in mind that the type and number of effectively available process-options depends on the given machine-configuration *(installed HW-/SW-options ...)* and the selected process-activity *(Pick, Place, Dispense ...)*.

Option	Description
Force	Controls the force applied during pick/place.
Beamsplitter	Camera inspection for exact chip/substrate alignment.
Die Ejector	Die ejector control for picking.
Bondline Thickness (BLT)	Place exeuction using a (previously) measured position (+ offset).
UV Curing	Glue curing/aging at place time via UV light source.
Scrub	Apply micro movements of the spindle/tool at place time.
Heating	Controls the heating system *(only available for certain activities like Pick, Place)*.

4.5 Repeated Execution

Certain types of activities *(e.g. Dispense, Stamp ...)* can be configured to execute a number of times in a row before the process switches to the next activity. Therefore, instead of adding the same activity 'n'-times to the process (in the ProcessEditor), it may be added only once and the repeat number set to 'n' in the ProcessView, instead. The "Repeated Execution" UI panel automatically becomes visible in the lower part of the ProcessView when selecting an activity with "Repeated Execution"-capability.

UI		Description
	1	**Repeat counter** The number of times the given process-activity was executed within the current process-cycle. Each new process-cycle resets the counter to 0. Note that this field is read-only.
	2	**Number of (desired) repeats** The number of times to execute the given process-activity before switching to the next. The default value is "1".

> ⚠️ **Repeat Handling**
>
> The number of repeats **can only be set for certain types of process-activitites**. Furthermore, **the process must be stopped/paused before changing the number** of (desired) repeats.
>
> Different situations need to be considered:
>
> 1. Changing the value for a <u>currently active</u> activity *(i.e. being executed)* <u>stops the process</u> and restarts it at the activity for which the repeat-value was changed.
> 2. Changing the value for an <u>already executed activity</u> continues the process normally. The new repeat-number will be used starting with the next process-cycle.
> 3. Changing the value for a <u>pending activity</u> *(i.e. not executed, yet)* continues the process normally. The new repeat-number will already be used in the ongoing process-cycle.
>
> The desired number of repeats is stored with the process like any other parameters. The repeat counter is reset to 0 whenever the process switches to the next activity or it is started new.

4.6 Inching

> (i) "Inching" is a special feature which **allows the user to intervene an _(auto-mode)_ process at pre-pick and/or pre-place positions** for performing the pick or place movement manually _(that is, the chip vacuum and die ejector are still automatically controlled by the software)_.

4.6.1 Inching Sequence

Step	Action	Effects
(1)	Process reaching pre-pick or pre-place position	■ "Inching" mode possible
(2)	**Inching activation/cancelling**	
(2a)	User pressing console "Lock" button	■ Current process stopped ■ "Inching" mode activated ■ Z-axis decoupled _(user taking over Z-axis control)_
or (2b)	User pressing console "Enter" button → Process continues normally to step (6)	■ "Inching" mode deactivated
(3)	User moving Z-axis to touchdown & applying required force → Pick: Continue with step (4) → Place: Continue with step (5)	■ Z-axis recoupled _(process/software taking over Z-axis control again)_
(4)	**"Inching Pick"**	
(4a)	Pick _(user controlled)_ started	■ Chip vacuum turned on ■ Pick time starting ■ _Die ejector needle/vacuum handling_
(4b)	Pick time end	■ Z-axis decoupled _(user taking over Z-axis control)_ ■ User taking over Z-axis control ■ _Die ejector needle/vacuum handling_ ■ Machine waiting for Z-axis recouple by user
(5)	**"Inching Place"**	
(5a)	Place _(user controlled)_ started	■ Place time starting
(5b)	Place time end	■ Chip vacuum turned off ■ Z-axis decoupled _(user taking over Z-axis control)_ ■ Machine waiting for Z-axis recouple by user
(6)	User recoupling Z-axis	■ "Inching" done ■ Machine waiting for user acknowledge
(7)	User pressing console "Enter" button → Acknowledge for process continuation	■ Current process resuming at next activity

4.6.2 Manual Vacuum Control

If even more manual control is desired, **the user has the possibility of explicitly switching the spindle vacuum and die ejector** (vacuum & cylinder).

> (i) Manual vacuum control _(for Inching)_ is activated by pressing the console "Manual" button when in Inching mode. Depending on the current state of the process (Pick, Place), the spindle vacuum and/or the die ejector are controlled in the same fashion as in <u>Manual mode</u>.
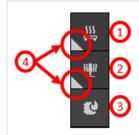
5 Heating Control

> ⚠️ **Machine Option**
>
> The functionality described here is only available on machines where the respective (Indel) "Heating Control" option is installed and enabled. Furthermore, please note that the heating control configuration can NOT be accessed if a pick/place process is started.

5.1 Heating Toolbar

(1) "Explicitly" activate/deactivate the substrate heating unit.

If the unit is already activated, it will be deactivated and put into "OFF" state. If the unit is deactivated, it will be activated and put into "STANDBY" state.

(2) "Explicitly" activate/deactivate the tool heating unit.

If the unit is already activated, it will be deactivated and put into "OFF" state. If the unit is deactivated, it will be activated and put into "STANDBY" state.

(3) Control the inertgas valve.

(4) Disable heating units temporarily.

> ✅ **Heating Unit Usage**
>
> All enabled heating units are activated/deactivated by the (pick/place) process-logic automatically. If you plan not to use a certain heating unit for a given (pick/place) process, you can deactivate the unit completely by clicking on the grey triangle part of the button *(marked red in the picture)* and selecting "Disable" *(or "Enable" for re-enabling again)*.
>
> The "Disable" status is persisted globally for each unit, i.e. the unit is kept disabled even after SW-restart until you enable it again.
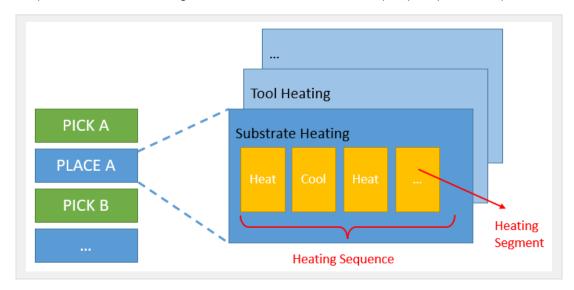
5.2 Heating Process Control

TSM provides the possibility of combining/linking its pick/place process-logic with heating control logic for eutectic processes. An individual heating process-configuration can be created for each pick/place process *(each process activity, resp)*. Separate **heating sequences** can be configured for each (pick/place) process-activity and for each heating unit *(e.g. substrate heating, tool heating ...)*. A single **heating sequence** may consist of serveral "steps" referred to as "**heating segments**".

The picture below denotes the logical structure and association between pick/place process (left part) and heating process (right part).

> ✓ **Configuration**
>
> For adding a new heating configuration to any given pick/place process, select an activity (e.g. Pick, Place) from the ProcessView and click on the "Heating"-button *(next to the respective process-option switch)* to open up the Heating Editor dialog. Don't forget to activate the heating process-option switch *(next to the "Heating"-button)* if you finally wish to activate/use the heating configuration in the given process-activity.
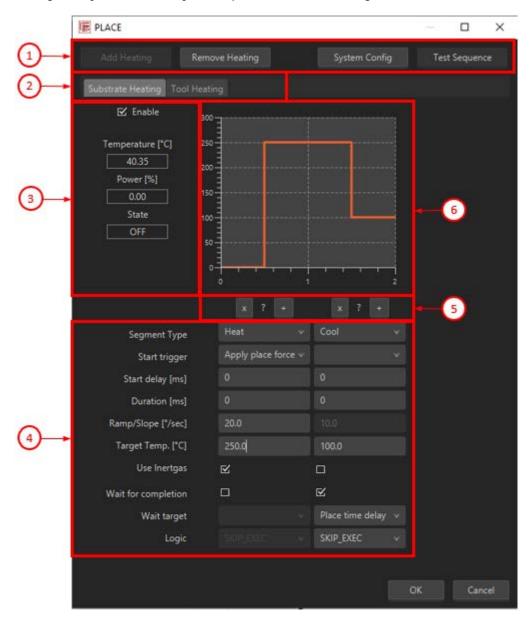>
>

> ⚠ **Heating Process Control**
>
> Heating process control is possible for ...
>
> - PICK and PLACE activities for processes in AUTO mode
> - The default Pick/Place process in MANUAL mode

5.3 Heating Editor

The heating editor allows for configuration and test of heating sequences. As already pointed out above, each sequence is associated to a single heating unit *(e.g. substrate heating)* and may consist of a number of segments.

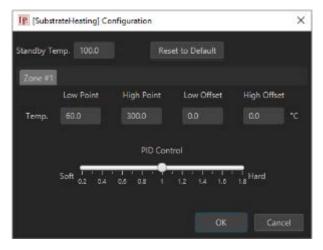|	Description
1	**Heating Configuration Button Bar** ■ "Add Heating": Adds a new heating process-configuration (heating sequence) to the actual process-activity. ■ "Remove Heating": Removes the existing heating process-configuration (heating sequence) from the actual process-activity. ■ "System Config": Opens the "Heating System Configuration" window for the actual process-activity. ■ "Test Sequence": Tests/executes the current heating sequence.
2	**Heating Unit Tabs** A separate heating sequence can be configured for each heating unit (and per process-activity). ⚠ **Heating Units** Keep in mind that the heating units available/shown depend on the given machine options/configuration.
3	**Heating Sequence Enable and Heating Unit Status** ■ Each heating-unit/heating-sequence may be enabled/disabled as required. ■ The current status, temperature and power-output of the actual heating unit is ⚠ **Heating Sequence Disable** Disabled heating sequences are neither considered in the associated pick/place process, nor when using the "Test Sequence" button. Instead, heating units of disabled sequences are put into "STANDBY" during pick/place. If you wish to COMPLETELY deactivate a given heating unit temporarily, you need to disable it via heating toolbar buttons.
4	**Heating Segment Configuration** A heating sequence is associated to a single heating unit. Each sequence may contain a number of segments. Parameters like segment type, start trigger, target temperature and others can be configured separately for each segment (see below for a detailed description of the heating segment configuration).
5	**Heating Segment Configuration** Contains buttons for adding new (+) or removing existing (x) heating segments.
6	**Heating Sequence Diagram** Shows the logical flow of the currently configured heating segments/sequence *(the Y-axis represents the target temperatures in °C)*. ⚠ **Scaling** Note that the diagram presents an "abstract" view of the heating sequence. That is, target temperature changes are simply displayed as "steps" and do not reflect the configured temperature ramps. Furthermore, the X-axis has NO "time base association" whatsoever.

5.4 System Configuration

The heating "system configuration" provides the possibility to adjust the heating system individually for each (pick/place) process.

	Description
Standby Temp.	The target temperature to use when putting the given heating unit into "STANDBY" state *(e.g. when finishing/cancelling a pick/place process).* For process-activities without heating control configured, the global standby temperature is used for the given unit, instead.
Offsets	The "Low Point", "High Point", "Low Offset" and "High Offset" textfields allow to compensate an existing difference between measured (sensor-) and effective temperature by means of a linear offset. Depending on factors like the context/environment, pick/place process and others, the temperature sensor might not exactly reflect the temperature at the desired location. For instance, the substrate heating sensor usually indicates a slightly higher temperature than the heating plate or the substrate placed on it effectively has. ■ A **POSITIVE offset** means the **sensor indicated temperature is HIGHER than the effective temperature**. The **desired/effective temperature is therefore INCREASED** by **increasing all target temperatures** by the offset value. ■ A **NEGATIVE offset** means the **sensor indicated temperature is LOWER than the effective temperature**. The **desired/effective temperature is therefore LOWERED** by **lowering all target temperatures** by the offset value. ⚠ **Offsets and Temperature Limits** Note that each heating unit has a specific max. temperature limit. As the offsets configured here are automatically added to target temperatures configured in the heating process, you need to take care to not get beyond the heating unit limits by increasing the offsets too much.
PID Control	Allows for adjusting heating PID control for the given heating unit and -process in a certain range. ■ "**Harder**" means the heating PID control is "**faster/more aggressive**" but also **less accurate** and may lead to **higher overshoot**. ■ "**Softer**" means the heating PID control is "**slower/less aggressive**" but also **more accurate**, leading to **less overshoot**.
Reset to Default	Resets all parameters (offset, PID control ...) to the default values.

5.5 Segment Configuration

Parameter	Description
Type	■ **Heat**: Heats up or "settles down" *(i.e. passively cools down)* the given heating unit to the target temperature. ■ **Cool**: "Actively" cools down the given heating unit to the target temperature. ⚠ **Active vs. Passive Cooling** Segments of type "Cool" always ACTIVELY cool the heating unit down by switching the respective cooling valve. If you wish to use PASSIVE cooling instead, you need to declare a "Heat" segment with a lower target temperature than the previous segment. This causes the heating controller to set the output power to 0% and wait until the actual temperature is "settled" to the lower target temperature *(i.e. without actively switching the cooling valve on)*.
Start Trigger	Defines the (pick/place) process-step (task) which should act as trigger for starting the given heating unit. That is, when the selected (pick/place) process-task is started, the respective heating segment is started. ⚠ **Heating and Process Logic** Note that process-tasks which are currently disabled in the given process are NOT available for selection here. That is, if a certain task is disabled *(e.g. due to some disabled process-options)*, the task will not show up in the list. Furthermore, mind that **a heating configuration can become invalid when changing the (pick/place) process sequence via process-options after setting up the heating start triggers**. For instance, if a certain process-task selected as "Start Trigger" gets subsequently disabled via process-option, the given heating segment will not receive the start event, anymore, **possibly causing the heating process and/or pick/place process to "stall"**.
Start Delay	Defines an additional delay *(given in [ms])* which is added AFTER the segment's start-condition becomes true *(i.e. the associated process-task was started)* and BEFORE effectively starting the given heating segment. ⚠ **Start Delay** The (pick/place) process logic is NOT affected by this delay directly as the heating logic is handled fully independent of /parallel to the (pick/place) process. Therefore, the process-task selected as "Start Trigger" and all subsequent tasks are executed independently of any delay value declared here.
Duration	The time *(in [ms])* to "hold" the target temperature.
Ramp/Slope	The temperature ramp to use *(in [°/sec])*. Only available for "Heat" segments. ⚠ **Max. Temperature Ramp** Note that **to achieve the max. temperature surge, the ramp value needs to be set to "0.0"**. In this case, the heating controller will first perform a "temperature jump" *(i.e. the power-output is set to 100% for a short time)* before switching to the PID control loop. Also note that the feasibility of such a "jump" depends on the difference of actual and target temperature. For instance, it is not possible to perform a "jump" for small temperature differences. The bigger the difference, the longer/wider the "jump".
Target Temperature	The target temperature of this segment. ■ For segments of type "**Heat**", the controller either heats up or "settles down" *(i.e. passive cooling)* to the target temp. ■ For segments of type "**Cool**", the controller cools down to the target temp by switching the cooling valve on *(i.e. active cooling)*.
Inertgas	Enables/disables the "Inertgas" valve for the given segment. The valve is turned on when the segment starts and turned off again when the segment is finished.
Wait for completion	Enables "Completion Handling" for the given segment which **instructs the pick/place process to wait for the heating process**.

| Wait target | The "Wait target" denotes a "task" from the pick/place process which is to be "blocked" by the heating-logic until the given heating segment is finished.

Depending on the "Wait logic" configuration (described below) **the pick/place process waits for the heating segment to finish ...**

- **before the selected task is executed (PRE_EXEC)**
- **after the selected task is executed (POST_EXEC)**
- **before the selected task is executed, skipping its execution entirely (SKIP_EXEC)** |
|---|---|
| Logic | Denotes the "wait strategy" of the "Completion Handling" describing the way/method the pick/place process-logic is supposed to wait for the heating logic. |

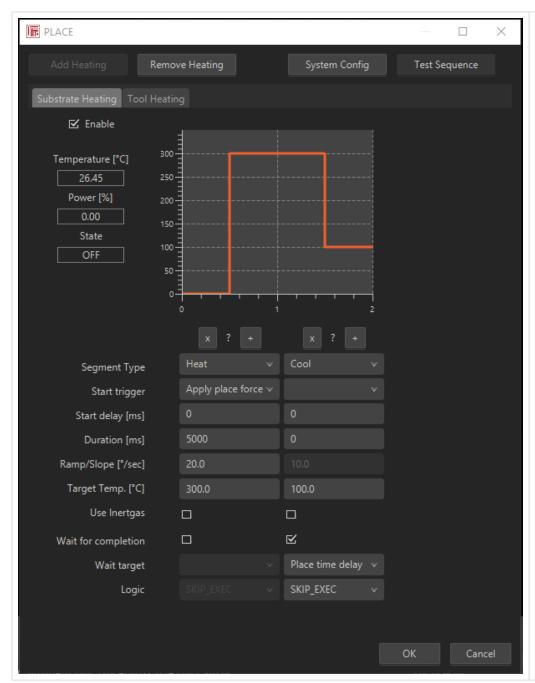# 5.6 Completion Handlig

5.6.1 General

Usually, the pick/place process-logic (upper row) acts as "master" and the heating-logic (lower row) as "slave", i.e. the **process-logic controls the heating**.

The "Completion Handling" option basically "reverts" this relationship temporarily by **allowing the heating-logic** (lower row) **to "block" the pick /place process-logic** (upper row) at a certain point until a given heating segment is finished.

The diagram above presents a practical example where the **"Start trigger"** is set to the **"Apply place force" task** and the **"Place time delay" task** is used as **"Completion Wait target"** together with the **"SKIP_EXEC" wait logic** *(as depicted on the picture to the left)*.

The effect of this heating configuration is that, after applying the force, the Z-axis will wait in place-position for the "Cool" heating segment to finish. Once the cooldown temperature is reached, the "Place time delay" task is skipped. Thereby, the place time is NOT defined by the "Place time delay" task setting but by the heating sequence configuration/execution, instead.

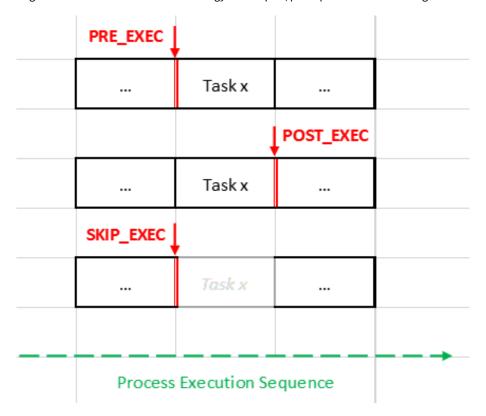⚠ **Completion Handling Consistency Checks**

Note that many other combinations of pick/place process and heating configuration are possible but cannot be illustrated here for brevity. Also, the **TSM** software implements some consistency checks that prevent the user from misconfiguring the "Completion Handling"-option. For instance, **the selected "Wait target" must denote a task that logically follows the "Start target"**.

However, although the process-sequence of a single pick/place activity is displayed as "sequence" in the Process View, internally it comprises many parallel execution paths transparent to the user. As a consequence and due to the high flexibility of the completion handling configuration, **situations might occur where a certain heating sequence is not executed as expected or even "stalls" the hetaing or the whole pick/place process**.

If you encounter such a situation, consider changing your heating process-configuration *(e.g. adapt start triggers/delays, completion handling parameters etc)*.

5.6.2 Wait Logic

Depending on the selected "Wait Target" and "Wait Logic", the user can influence the behavior of the process- and heating-logic differently. The "Wait Logic" defines the concrete "wait strategy" of the pick/place process when waiting for a heating segment ("Wait Target") to finish.

| Wait Strategy	Description
PRE_EXEC	The process-task selected as "Wait Target" (Task x) **first waits** for the heating segment to finish and **then executes** normally. If the heating segment was finished before "Task x" has started, the task does not wait *(but executes immediately)*.
POST_EXEC	The process-task selected as "Wait Target" (Task x) **first executes** normally and **then waits** for the heating segment to finish *(before switching to the next task)*. If the heating segment was finished before "Task x" has finished, the task does not wait *(but switches to the next task immediately)*.
SKIP_EXEC	The process-task selected as "Wait Target" (Task x) **first waits** for the heating segment to finish and **then skips** execution. If the heating segment was finished before "Task x" has started, the task does not wait *(but skips execution immediately)*.
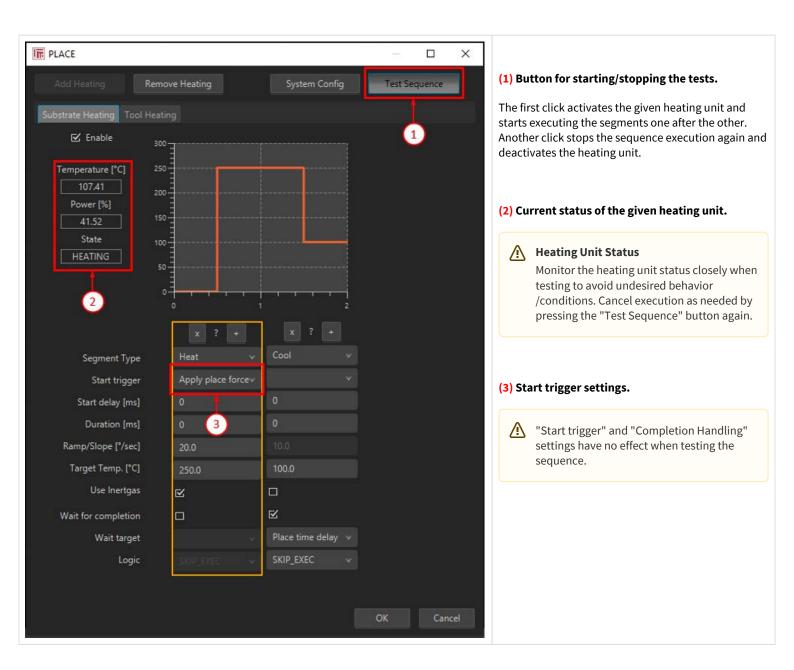
5.7 Sequence Testing

Heating sequences can be executed for testing purposes without having to run a pick/place process. By pressing the "Test Sequence" button (1) on the Heating Editor, the heating logic will activate the given heating unit and run one heating segment after the other as configured. The currently active /executed segment is indicated with a yellow border. In case of severe errors, execution will stop and the border color will change to red.

> ⚠ **Start Trigger**
>
> Note that **the "Start trigger" and "Completion Handling" settings have no effect when testing the sequence** *(as no pick/place process is running)*.

(1) Button for starting/stopping the tests.

The first click activates the given heating unit and starts executing the segments one after the other. Another click stops the sequence execution again and deactivates the heating unit.

(2) Current status of the given heating unit.

> ⚠ **Heating Unit Status**
>
> Monitor the heating unit status closely when testing to avoid undesired behavior /conditions. Cancel execution as needed by pressing the "Test Sequence" button again.

(3) Start trigger settings.

> ⚠ "Start trigger" and "Completion Handling" settings have no effect when testing the sequence.

6 Service Configuration Area

The Service Configuration Area provides possibilities to configure/adjust different machine-options and related parameters. To access it, click on the "Service View"-button shown on the [About Dialog](#):
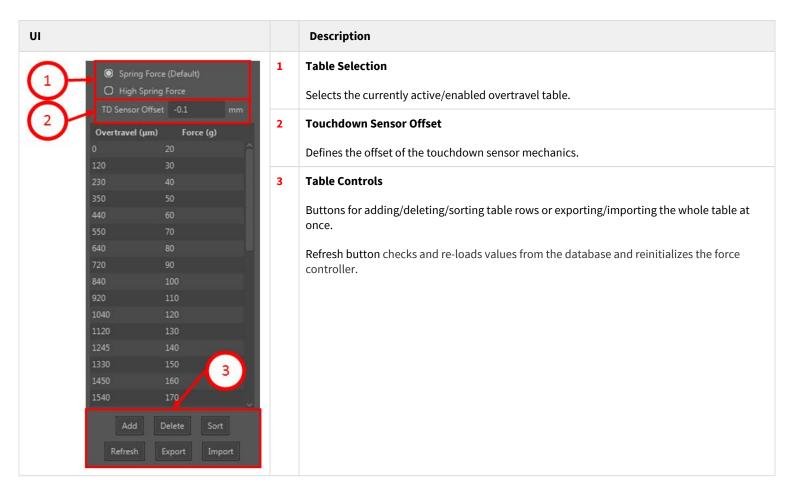
⚙️

6.1 Force Control

6.1.1 Force Tables

A "Force Table" defines how a specific force controller reacts for achieving a given (desired) force. That is, it presents a mapping of some control value (i.e. the input to the force controller) and the resulting force (i.e. the output of the force-controller). The output is usually the resulting (desired) force in [g]. The input, on the other hand, depends on the force controller type. For the "Spring Force" controller, the input is an overtravel distance in [um] which is required to achieve the given force. For the "High Force" controller, the input can be an analog signal that controls a proprtional valve which in turn controls a cylinder for applying the desired force.

Note that a separate table is maintained for each force type *(e.g. standard spring force/high spring force, high-force ...).* The table values can be manipulated directly.
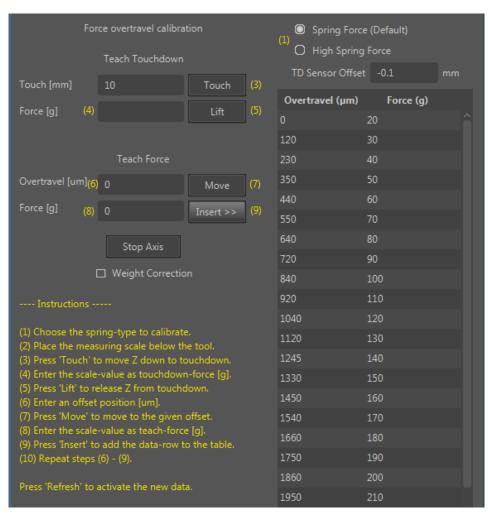
> ⚠️ **Refresh**
>
> Please note that **you need to press "Refresh"** for changes made to the table to get active. That is, **the software does NOT need to be restared** after the changes but the values need to be "refreshed".

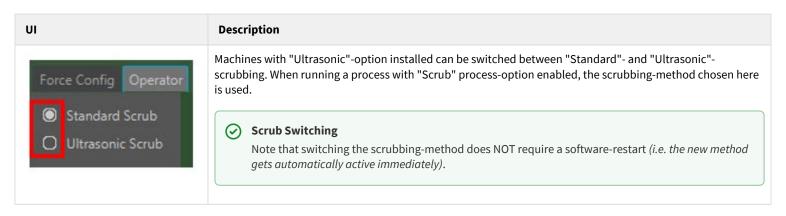| UI		Description
	1	**Table Selection** Selects the currently active/enabled overtravel table.
	2	**Touchdown Sensor Offset** Defines the offset of the touchdown sensor mechanics.
	3	**Table Controls** Buttons for adding/deleting/sorting table rows or exporting/importing the whole table at once. Refresh button checks and re-loads values from the database and reinitializes the force controller.

6.1.2 Spring Force Calibration

When using the (interactive) spring force calibration feature, please simply follow the instructions presented in yellow.

Force overtravel calibration

(1) ⦿ Spring Force (Default)
○ High Spring Force

TD Sensor Offset -0.1 mm

Teach Touchdown

Touch [mm] 10 [Touch] (3)

Force [g] (4) [Lift] (5)

Teach Force

Overtravel [um] (6) 0 [Move] (7)

Force [g] (8) 0 [Insert >>] (9)

[Stop Axis]

☐ Weight Correction

---- Instructions -----

(1) Choose the spring-type to calibrate.
(2) Place the measuring scale below the tool.
(3) Press 'Touch' to move Z down to touchdown.
(4) Enter the scale-value as touchdown-force [g].
(5) Press 'Lift' to release Z from touchdown.
(6) Enter an offset position [um].
(7) Press 'Move' to move to the given offset.
(8) Enter the scale-value as teach-force [g].
(9) Press 'Insert' to add the data-row to the table.
(10) Repeat steps (6) - (9).

Press 'Refresh' to activate the new data.

Overtravel (µm)	Force (g)
0	20
120	30
230	40
350	50
440	60
550	70
640	80
720	90
840	100
920	110
1040	120
1120	130
1245	140
1330	150
1450	160
1540	170
1660	180
1750	190
1860	200
1950	210

6.2 Operator Functions

6.2.1 Scrub Method

UI	Description
	Machines with "Ultrasonic"-option installed can be switched between "Standard"- and "Ultrasonic"-scrubbing. When running a process with "Scrub" process-option enabled, the scrubbing-method chosen here is used. ✓ **Scrub Switching** Note that switching the scrubbing-method does NOT require a software-restart *(i.e. the new method gets automatically active immediately)*.

6.2.2 Beam splitter camera autoswitch

UI	Description
	When this function is enabled, the beam splitter camera picture is **automatically** shown on the main camera view whenever the beam splitter is in its work position (convenience function).

7 Troubleshooting

This section contains important information related to the **TSM** software in general and how to deal with errors and other issues.

7.1 About Dialog

7.1.1 User Interface

UI	Description
	The "About Dialog" is opened by first selecting the **Tresky button** (1) from the main toolbar and then the **Info button** (2) from the opened menu: It provides several additional information and functionality with respect to the **TSM** software. • Program and database versions • License disclaimers • User level handling • Configuration area access *("Service View")* • Log export

7.1.2 User Level Handling

TSM incorporates a dedicated users/rights concept. The default user level on application startup is "OPERATOR". By providing the respective password for the selected level *("Password"-field in the About Dialog above)*, the user level can be changed for unlocking additional functionality.
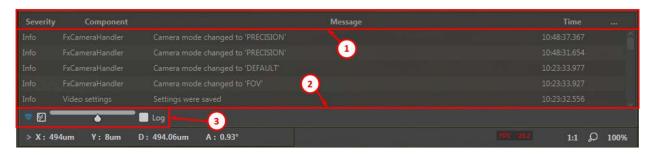
> ⚠️ **User Levels**
>
> Note that currently it is not possible to administer the user levels/rights and passwords. That is, only the pre-defined user levels *(and associated passwords)* can be used.

7.2 Logging

7.2.1 User Interface

Most relevant info-, warning- and error-messages of the **TSM** application are logged to the Log View.

(**1**) Log View header containing the different log columns. Log entries are automatically sorted by the timestamp of their occurence. Sorting can be changed by clicking on one of the *(header)* columns. A 2nd click on the same column switches from ascending to descending order and vice versa.

(**2**) Log message list.

(**3**) Controls for expanding/collapsing and changing the opacity of the Log View.
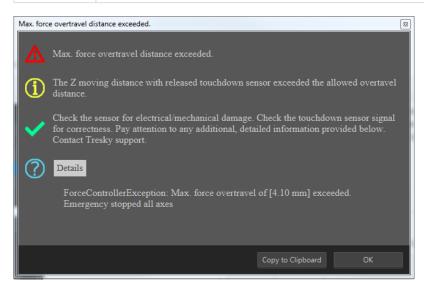
> ⚠ It is important to note that, the log view of the user interface does NOT contain all log entries made within the application. It shows mainly user-relevant information. The full list of log entries is only contained in the application logfiles/-tables. For doing a reasonable investigation /analysis in case of malfunctions and other problems, it is essential for the Tresky support to receive the relevant application logs. See the sections of the "About Dialog" and the "Logging" for more information.

7.2.2 ECS

The **TSM** application incorporates the so-called **"Error-Cause-Solution" (ECS) concept** as a feature to support troubleshooting and provide additional information in case of problems.

 Certain messages *(warnings, errors)* are presented in the Log View with an additional **ECS-icon** *(marked red in the picture to the left)*. The icon indicates, that **the given log entry contains additional information**. A single click on the icon opens up a dialog with the respective information.

The ECS information is structured into three distinct sections:
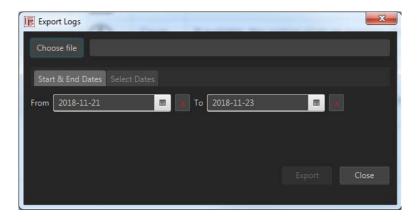
Symbol	Section	Description
⚠	Error	Gives a rough description of the issue/problem.
ⓘ	Cause	If available, this section gives an overview of any possible causes of the problem.
✓	Solution	If available, this section gives hints as how to overcome/workaround the problem.
	Details	If available, this section provides additional (technical) details which can prove useful to the Tresky personnel for investigating the issue.

> ✓ **Tresky Support**
>
> ECS information can be easily provided to Tresky support in case of problems by simply clicking the "Copy to Clipboard" button and pasting the copied data into an email or text file.

7.2.3 Log Export

Where the Log View *(mentioned above)* only shows part of the messages *(those relevant to the user)*, the <u>full application logs contain additional information</u> necessary for the Tresky personnel to do reasonable investigation/analysis in case of malfunctions and other problems. Thus, it is important to provide this information to Tresky support in case of issues related to the **TSM** software. The application logs are exported by simply selecting the "Export Logs" button on the About Dialog and choosing the desired "Start & End Date". **For reducing the amount of exported data, please choose the "Start & End Dates" wisely.** Usually, it is enough to set the "Start Date" to only a couple of days before the day a given problem occured.

By selecting the "Choose file" button, an arbitrary export destination can be chosen for the file *(e.g. the PC or an external USB drive)*. The file name of the export will be pre-defined and does not need to be changed.

Clicking the "Export" button finally writes the application logs to the given destination. The created zip-file can then be provided to Tresky support together with any additional information *(e.g. ECS clipboard)* which may help in investigating/resolving the given issues.

> ⊘ **Tresky Support**
>
> For facilitating analysis and guaranteeing straightforward support from Tresky, it is **important to provide as much of the present/available information about the specific problem as possible**:
>
> - Time/Date when the issue(s) occured
> - Detailed problem description *(situation, context, actions taken, repeatability, ...)*
> - Program- and database versions *(About Dialog)*
> - Exported application logs *(About Dialog)*
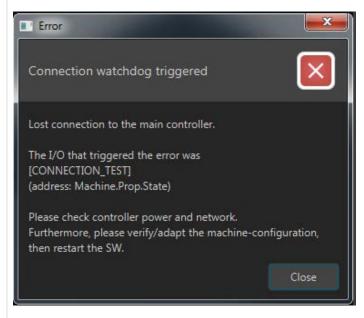> - ECS (clipboard) information *(of relevant errors)*

7.3 Fatal errors

If a fatal error occurs, an emergency stop/disable is performed on all axes *(cancelling any ongoing process, at the same time)* and a respective message is printed to the log *(and/or a notification presented to the user)*. For some fatal errors, the user interface of the **TSM** application will typically be automatically blocked in such a case for avoiding further operation of the machine.
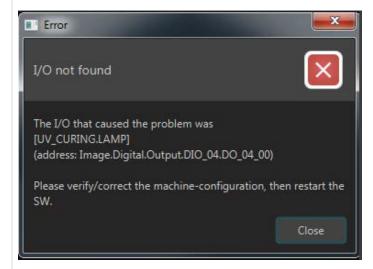
Error	Description
Connection problem	The notification pops up when detecting a problem with the connection to the main controller. Typically, this indicates a HW-related problem (e.g. network cable/infrastructure, controller power). The main toolbar is automatically blocked for safety reasons. However, the user still has the possibility to enter the "Configuration Area" *(for making corrections to the machine configuration)* or the "About Dialog" for exporting the application logs.
I/O not found	The notification pops up when detecting a problem while reading/writing a specific I/O. Usually, such an issue will happen only directly when the **TSM** application is started. It indicates that a certain I/O (address) was not found or could not be handled properly by the main controller. The main toolbar is automatically blocked for safety reasons. However, the user still has the possibility to enter the "Configuration Area" or the "About Dialog" for exporting the application logs.

T-SuiteM v2.0 Vision Documentation

1 Purpose

T-Suite Vision is a vision-application based on Tresky's TreskySuite SW-Platform. It replaces the old "T-Vision" application, providing vision-functionality for Tresky's manual die bonding machines. Apart from other *(mostly supporting)* features *(e.g. measurements, shapes, overlays...),* its main aim is to allow the displaying of and switching between multiple connected cameras.

2 Environment

TSuite Vision was developed for and tested on standard (consumer-)PCs and runs on Windows 7 & Windows 10 (64bit) operating systems. Below you can find a list of officially supported IDS cameras. Furthermore, **all USB 2.0 & USB 3.0 cameras supporting the Microsoft DirectShow® interface should work** *(though no 100% guarantee can be given)*.

2.1 Supported IDS Cameras

- UI-31590CP-C-HQ R2
- UI-1240LE-C-HQ
- UI-1250LE-C
- XS

2.2 System Requirements

2.2.1 Minimum Specification

- Intel/AMD CPUs: Intel Core i5 (4th gen.)
- 3 GB RAM
- Full HD monitor (1920px * 1080px)
- USB 2.0, USB 3.0 ports
- Windows 7 64 bit Professional SP1 or newer*

2.2.2 Recommended Specification

- Intel Core i5 (4th gen. or later)
- 8 GB RAM
- Full HD monitor (1920px * 1080px)
- USB 2.0, USB 3.0 ports
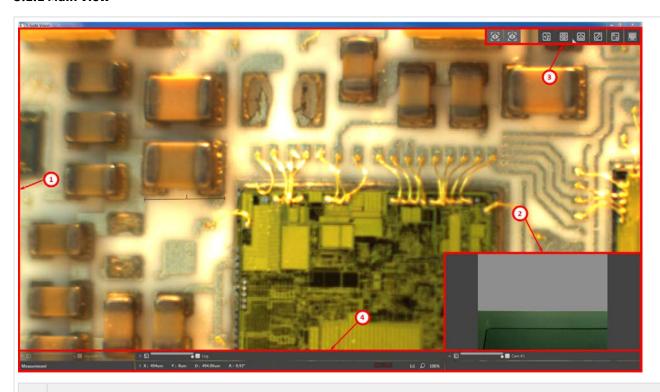- Windows 7 64 bit Professional SP1 or newer*

*) Windows 8.1 is not officially supported.

3 User Interface

3.1 General

The TSuite Vision application was designed in a modern "dark theme" look-and-feel. All UI-controls feature a "flat" design. State-changes of buttons are indicated by changes in the background-color *(e.g. dark gray light gray)*. The main user interface incorporates a **main view** *(displaying the picture of the currently configured main camera)* and several **supporting views** *(providing additional functionality)*. All views were designed for a maximum of usability, user friendliness and flexibility. Therefore, each supporting view can be expanded/collapsed and additionally changed in opacity as described below.

3.1.1 Main View

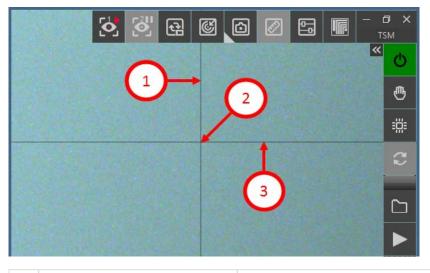|	Description
1	**Main Toolbar** Contains "main" functions/buttons for camera control and other features. Includes UI controls for window handling.
2	**Main Camera View** The main camera view is the central view of the TSuite Vision application and displays the video image of the currently configured main camera. **The "anchor point" of the video image is in the top-left corner of the screen.** This means that, if the camera resolution is increased, the video image expands into the direction of the bottom-right corner of the screen *(on the other hand, resolution reductions "shrink" the video image into the direction of the top-left corner)*.
3	**Aux. Camera View** The auxiliary camera view displays the video image of the currently configured auxiliary camera. It is only present on systems with more than 1 camera connected/available. The auxiliary view automatically expands as you start the aux. camera *(the view automatically collapses, as soon as the respective camera is stopped again)*.
4	**Statusbar** Displays status information *(e.g. measurement, coordinates, zoom, log…)*

3.1.1.1 Crosshairs

1-3	Crosshair mouse interaction points	Mouse dragging points for 1) vertical axis 2) both axes and 3) horizontal axis.

3.1.2 Supporting Views

TSuite Vision incorporates several additional views which support the user's work. For convenience, all these views can be collapsed/expanded and adjusted in transparency.

	Element	Description
1	Expand/Collapse	Allows the individual view to be expanded/collapsed.
2	Opacity Slider	Allows the individual view's transparency to be adjusted.

3.1.3 Window Handling (Size, Position)

> ⊘ **Window Handling**
>
> Note that you can resize the application window normally in its width and height at each four corners. For moving the window around, grab it at the "TSV" label *(red marked area on the picture below)*.
>
>

3.2 Main Toolbar

The main toolbar contains the "main" functions/buttons for camera control and other features.

	Element	Description
1	**Camera Control #1**	Starts/stops camera #1. Only available if at least 1 camera is connected.
2	**Camera Control #2**	Starts/stops camera #2. Only available if at least 2 cameras are connected.
3	**Camera Control #3**	Starts/stops camera #3. Only available if at least 3 cameras are connected.
4	**Swap Cameras**	Swaps the currently configured main and auxiliary cameras. Only available if at least 2 cameras are connected.
5	**Camera Mode**	Switches the mode of the currently configured main camera.
6	**Screenshot**	Creates a screenshot of the *(main)* camera picture or *starts the video recording (not available yet)*.
7	**Measurement Mode**	Switches between single- and multi-measurement mode.
8	**Video Settings**	Allows adjustment of different video settings like exposure, brightness, gamma...
9	**T-Settings**	Miscellaneous settings.
10	**Window Handling**	Controls for resizing and re-positioning the application window.
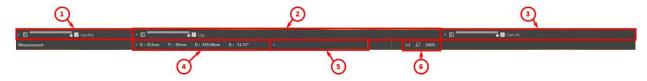
3.2.1 T-Settings

The "Tresky"-button provides some additional functions and settings.

Video Settings Button *(toolbar)*		**"Tresky" Button** *(toolbar)*
Camera Settings		**Overlay**
Help		**About**

3.3 Statusbar

Contains several sub-views, mainly presenting status information *(e.g. measurement, coordinates, zoom, log…).*

|	Element	Description
1	**Joystick View**	Allows for "shifting" the camera picture in X- and Y-directions when in "Precision" camera mode.
2	**Log View**	Contains the info/warning/error log messages of the TSuite Vision application.
3	**Aux Camera View**	Allows for presentation of an additional *(auxiliary/supporting)* camera picture.
4	**Measurement View**	Shows a table with the result(s) of the last performed measurement(s).
5	**Shapes View**	Shows a table with the coordinate(s) of the user-created shape(s) on the screen.
6	**Zoom**	Allows for zooming into or out of the main camera picture. A click on the 1:1 symbol resets the zoom.

4 Camera Operation
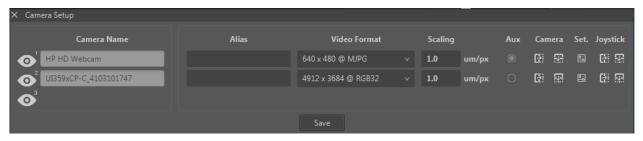
4.1 Main Functions

4.1.1 Camera Control

The toobar buttons for cameras 1-n start and stop the "live-image" of the given camera device. If the respective device is configured as "main camera", the video image is presented in the "Main Camera View" *(any previous "main camera" is stopped)*. If the device is configured as "auxiliary camera", the video image is presented in the "Auxiliary Camera View" *(any previous "auxiliary camera" is stopped)*.

4.1.2 Camera Settings

The camera settings allow for configuration of some basic parameters for each single camera *(e.g. video format, camera name, flipping...)*.

Field	Description
Camera Name	System camera name (cannot be changed).
Alias	User-defined name for the given camera.
Video Format	Selected video format for the given camera.
Scaling	Pixel-scaling of the video image *(in [units per pixel], e.g. "micron per pixel)*. Note that for the scaling to be accurate, it has to be measuread/determined and configured for each camera/optics individually.
Aux	Shows, which camera is currently configured as "auxiliary" camera *(i.e. assigned to the auxiliary camera view)*.
Camera	Allows for flipping the video image in horizontal/vertical direction.
Set.	Opens the video settings view for the main camera.
Joystick	Allows for flipping the camera-joystick control in horizontal/vertical direction.

> ⚠ Camera numbers *(sequences)* are assigned by the operating system and **cannot be changed by the user**. If you are not satisfied with the order of the cameras on your system, you can try to change it by connecting the camera to a different USB-socket *(no guarantee can be given, however, that the cameras will be assigned by the OS exactly as you desire it)*. Please also note that **disconnecting/connecting the cameras must not be done with a running application**. Always make sure to shut down TSuite Vision before doing any hardware-changes!

4.1.3 Camera Modes

Depending on the specific device-capabilities, TSuite Vision provides the possibility to operate the cameras in different "modes". Depending on the mode used, the result can either be increased (camera-)performance or a higher-detailed camera picture. For cameras supporting multi-mode, the **"Field-of-View" mode (FOV)** is the default mode which is active on application startup *(unless configured differently by the user)*. When the mode-selection button is pressed, the program switches to **"Precision"-mode** for the respective main camera *(button changes to light-gray background color)* .

Field-of-View (FOV) mode (for max. field-of-view)

Precision mode (for max. resolution/detail)
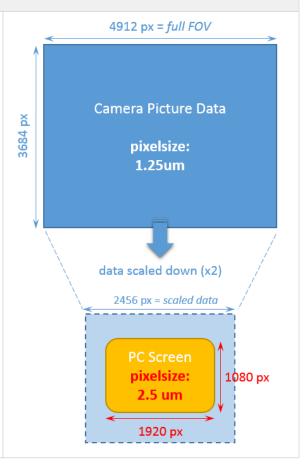

Field-of-View Mode (FOV)

In this mode, **the whole field-of-view of the main camera is presented on the screen**, however **at a lower resolution**. That is, **the picture is scaled down by the camera-hardware by a fixed factor** *(e.g. 2x)*. The advantage of this approach is <u>improved performance when you need to see the whole field-of-view of the camera</u>. The downside is less detail, as the camera pixel-size is bigger than in precision-mode.

> ⚠️ **Binning Factor**
> The factor by which the picture is scaled down in FOV-mode depends on the camera model and **cannot be configured by the user** *(usually 2x or 4x)!*

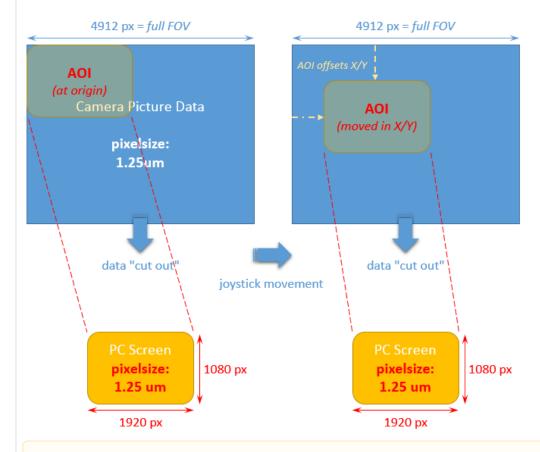*The illustration to the right is based on the "UI-31590CP-C-HQ" camera model.*

4912 px = *full FOV*

3684 px

Camera Picture Data

pixelsize: 1.25um

data scaled down (x2)

2456 px = *scaled data*

PC Screen
pixelsize: 2.5 um

1080 px

1920 px

PRECISION Mode

The precision mode is **recommended for cases where the max. possible accuracy** *(i.e. most picture detail)* **is needed**. That is, **a part of the full picture** *(of the full field-of-view)* **is cut out by the camera-hardware** and presented on the screen. The advantage of this mode is that you can work with the max. possible resolution of the camera *(that is, the smallest possible pixel-size)*. The downside, however, is that only a part of the whole field-of-view of the camera is presented.

The part of the full camera picture that is presented to the user in precision mode *(on the main camera view)* is commonly referred to as **"Area of Interest" (AOI)**. The AOI can be shifted by means of the joystick-buttons in X- and Y-directions *(see the "Joystick View" section for details)*.

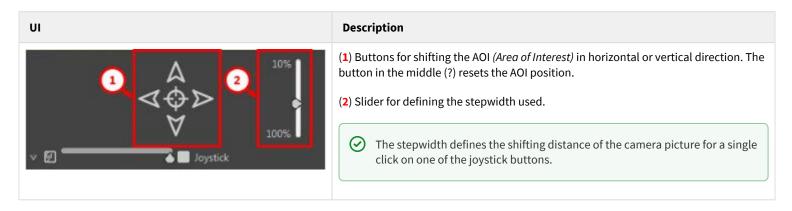*The illustration below is based on the "UI-31590CP-C-HQ" camera model.*

⚠ **Precision Mode Availability**

Please note that **the availability of the "PRECISION"-mode depends on the used camera**. Not all camera-models provide such a functionality!

4.1.4 Joystick

For camera models supporting "PRECISION"-mode, the AOI (Area of Interest) can be shifted around by means of the joystick buttons.

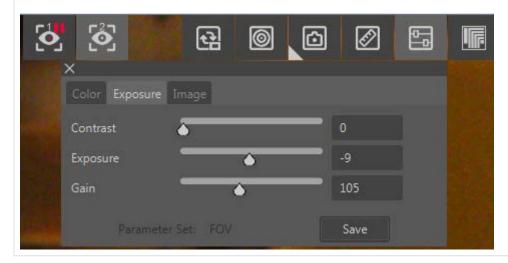| UI	Description
	(**1**) Buttons for shifting the AOI *(Area of Interest)* in horizontal or vertical direction. The button in the middle (?) resets the AOI position. (**2**) Slider for defining the stepwidth used. ✓ The stepwidth defines the shifting distance of the camera picture for a single click on one of the joystick buttons.

4.1.5 Camera Swapping

The camera "swap button" swaps the currently configured main- and auxiliary cameras. That is, the main camera is "moved" to the auxiliary view and vice versa.

⚠ Note that, after swapping, the former aux. camera becomes the new main camera and vice versa. Therefore, all main camera operations *(e.g. video quality)* are then targeted at the "new" main camera.

4.1.6 Camera Video Parameters

The application provides the **possibility for adjusting video parameters (exposure, brightness, gamma ...) for each camera separately**. Furthermore, **a specific video parameter set is maintained for each camera-mode.** That is, one can adjust the camera picture for each camera and each possible camera-mode separately.

⚠️ Keep in mind that the settings are **always applied to the currently configured main camera!**

⚠️ If you want to adjust the video parameters, please make sure that the respective main camera is running. Only then the video parameters button is avaiable from the toolbar. Furthermore, please note that **not all cameras support all possible video parameters**. If you change the slider of a certain parameter and do not notice any change in video-quality, chances are high that the respective video parameter is not supported and therefore has no effect on the given camera.

✅ Each camera supports at least one set of video parameters which can be adjusted and saved by the user. For cameras supporting different camera modes, the TSuite Vision application maintains one set of video parameters for each mode separately. Therefore, when switching from one camera mode to another, the values of the video parameter dialog are adjusted to the values of the video parameter set which is associated to the given/new mode. The name of the currently active video parameter set is shown on the left-hand side of the "Save"-button.

⚠️ If you want to permanently persist any changes made to the video parameters, **you have to explicitly "Save" them**. Please keep in mind that, without saving the new settings will only be active for the current session and reset to the former values after application restart!
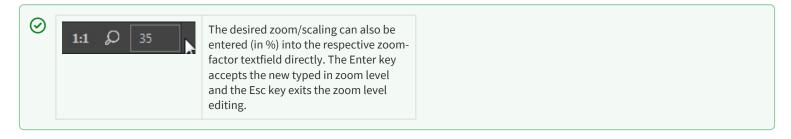
4.2 Additional Functions

4.2.1 Zoom

The "Zoom"-feature allows for scaling the main camera picture in both up/down directions *(conforms to zooming out/in)* using the mouse-wheel. The active zoom/scaling factor is indicated (in %) in the textfield next to the magnifier symbol. A click on the "1:1"-symbol resets the zoom.

Basically, two different zoom-modes are available: "zoom-to-center" and "zoom-to-mouse".

- **"Zoom-to-Center"**: The camera picture is scaled (in/out) **with respect to the center of the picture**.
- **"Zoom-to-Mouse"**: While holding the shift key, the camera picture is scaled (in/out) **with respect to the location of the mouse-pointer**.

When zoomed, the picture can be panned by holding the alt key while dragging the picture with the mouse.

The desired zoom/scaling can also be entered (in %) into the respective zoom-factor textfield directly. The Enter key accepts the new typed in zoom level and the Esc key exits the zoom level editing.

4.2.2 Measurements

Measurements are controlled by using the middle *(mouse-wheel)* button:

1. Move the mouse-pointer to the *(main camera view)* location of your measurement start point.
2. **Click** the middle mouse *(wheel-)*button a **1st time** to **start the measurement**.
   → the measurement line appears on the screen and follows the mouse pointer as you move it
3. Move the mouse-pointer to the *(main camera view)* location of your measurement end point.
4. **Click** the middle mouse *(wheel-)*button a **2nd time** to **stop the measurement**.
   → the measurement line is fixed on the screen *(i.e. it stops following the mouse movements)*
   → the measurment result *(X, Y, length, angle)* is shown in the status bar
5. **Click** the middle mouse *(wheel-)*button a **3rd time** to **remove the last measurement** results/shapes from the screen *(if in "Single"-mode)* or **start the next measurement** *(if in "Multi"-mode)*.
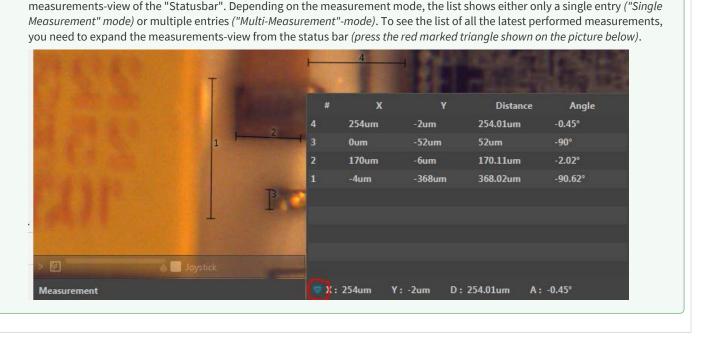
Measurements can be done in two different modes: "**Single Measurement**" and "**Multi-Measurement**" mode.

Mode	Description
Single ![icon]	In "Single Measurement"-mode, **only one** (the last) **measurement is shown/visible** on the main camera view. Any 3rd click on the middle mouse-button removes the last performed measurement. stop's at the second click on the wheel.
Multi ![icon]	In "Multi-Measurement"-mode, **several consequently performed measurements can be shown/visible** on the main camera view. To stop the mode and remove the measurements from the screen, click the measurement button once again *(automatically switches to single-mode)*.

> ⊘ The different measurements are numbered according to the creation-sequence. All measurement-results are gathered in the measurements-view of the "Statusbar". Depending on the measurement mode, the list shows either only a single entry *("Single Measurement" mode)* or multiple entries *("Multi-Measurement"-mode)*. To see the list of all the latest performed measurements, you need to expand the measurements-view from the status bar *(press the red marked triangle shown on the picture below)*.
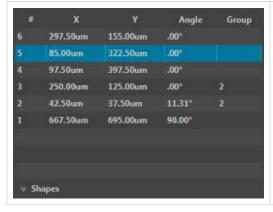>
>

> ⚠ **Measurements Layer**
> If you do not see any measurement lines/results on the screen, please make sure that the "measurements layer" from the ["Screenshot"-settings](#) dialog is activated!

4.2.3 Shapes

The main camera view provides a context menu for different sorts of shape-operations on top of the camera picture. The context menu is opened by a right mouse-button click on the main camera view.

Menu	Menu Item	Description
	New Box	Creates a new rectangle shape.
	New Circle	Creates a new circle shape.
	New Line	Creates a new line shape.
	New Point	Creates a new point shape.
	New Triangle	Creates a new triangle shape.
	Group	Forms a new shape group from currently selected shapes. Hold control key to select multiple shapes.
	Ungroup	Removes selected shapes from their group.
	Line Properties	Adjusts line color, thickness and smoothing of the selected shape or a measurement line.
	Shape Rotation	Adjusts the selected shape rotation angle. Some shapes - for example a circle - cannot be rotated.
	Load Shapes	Loads all shapes from disk.
	Save Shapes	Saves all shapes to disk. Shapes are stored as XML.
	Delete Shape	Deletes a selected shape after the user clicks Yes in a confirmation dialog.
	Clear all Shapes	Clears all the shapes from the screen after the user clicks Yes in a confirmation dialog.
	Load Snapshot	Loads one or more snapshots from disk.
	Take Snapshot	Creates a snapshot. Perform a drag and drop gesture on the camera image to select a region.

The "Shapes View" shows the dimensions of the user-created shapes on the screen. The sequence numbers of the individual shapes drawn are indicated on each shape as well as in the first column of the list. Changes to shape dimensions and groups are updated in the Shape View.
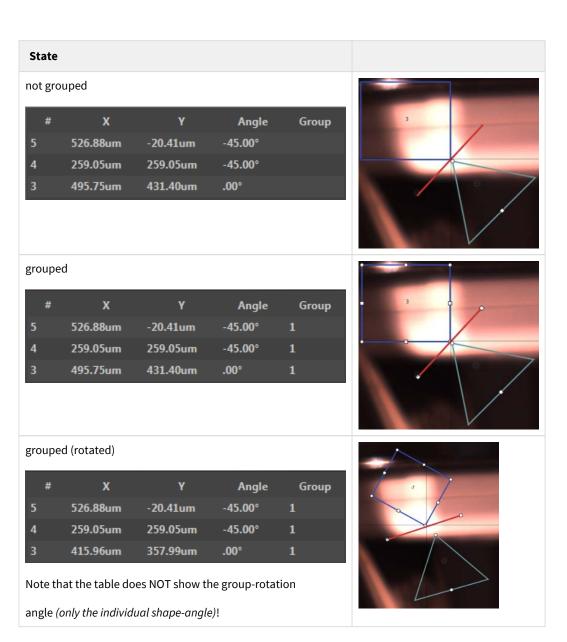
> ⚠ **Shapes Layer**
> Please remember that the shapes will only be visible, if the respective "Shapes"-layer is activated in the "Screenshot Settings".

4.2.4 Shape Grouping

Shapes can be grouped in order to be able to apply common operations *(e.g. movements or rotations around the common center)* to all contained shapes. The group a shape is associated to is indicated in the "Group" column of the "Shapes" table. Furthermore, the groups are also preserved when saving and reloading shapes.
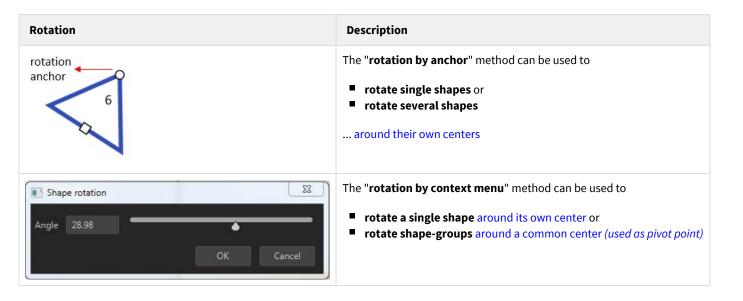
State	
not grouped <table><tr><th>#</th><th>X</th><th>Y</th><th>Angle</th><th>Group</th></tr><tr><td>5</td><td>526.88um</td><td>-20.41um</td><td>-45.00°</td><td></td></tr><tr><td>4</td><td>259.05um</td><td>259.05um</td><td>-45.00°</td><td></td></tr><tr><td>3</td><td>495.75um</td><td>431.40um</td><td>.00°</td><td></td></tr></table>	
grouped <table><tr><th>#</th><th>X</th><th>Y</th><th>Angle</th><th>Group</th></tr><tr><td>5</td><td>526.88um</td><td>-20.41um</td><td>-45.00°</td><td>1</td></tr><tr><td>4</td><td>259.05um</td><td>259.05um</td><td>-45.00°</td><td>1</td></tr><tr><td>3</td><td>495.75um</td><td>431.40um</td><td>.00°</td><td>1</td></tr></table>	
grouped (rotated) <table><tr><th>#</th><th>X</th><th>Y</th><th>Angle</th><th>Group</th></tr><tr><td>5</td><td>526.88um</td><td>-20.41um</td><td>-45.00°</td><td>1</td></tr><tr><td>4</td><td>259.05um</td><td>259.05um</td><td>-45.00°</td><td>1</td></tr><tr><td>3</td><td>415.96um</td><td>357.99um</td><td>.00°</td><td>1</td></tr></table> Note that the table does NOT show the group-rotation angle *(only the individual shape-angle)*!	

⚠ Note that, whenever a shape-group is ungrouped again, all rotation information of the group is lost *(a respective warning message is presented before ungrouping)*.

4.2.5 Shape Rotation

Shapes can be rotated uisng two different methods

- by selecting the "**rotation anchor**" of the given shape and moving the mouse cursor
- by opening the **context menu** on a given shape and choosing "Shape Rotation"

Rotation	Description
	The "**rotation by anchor**" method can be used to - **rotate single shapes** or - **rotate several shapes** ... around their own centers
	The "**rotation by context menu**" method can be used to - **rotate a single shape** around its own center or - **rotate shape-groups** around a common center *(used as pivot point)*

4.2.6 Overlay

The "Overlay" functionality allows for loading a picture selected by the user and presenting it as *(transparent)* "overlay" on top of the current main camera picture.

> ⚠ Please note that not all picture formats are supported as overlays *(mainly due to the lack of "transparency")*. Furthermore, the respective "Overlay" layer must be enabled on the "Screenshot Settings" dialog for the loaded picture to be visible!

4.2.7 Screenshots
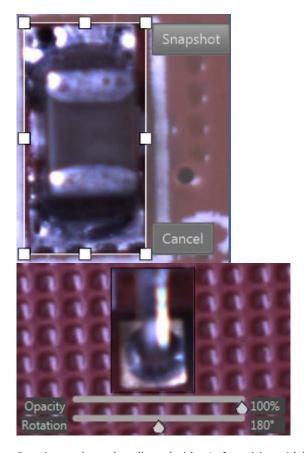
The screenshot button has multiple functionality.

- The **"main" button** is used for **creating a screenshot** of the currently visible picture of the main camera.
- The **"settings"-button** *(white triangle in the lower left corner)* is used for configuring different parameters of the screenshot-feature.

4.2.7.1 Settings

UI	Description
	- The screenshot can be configured to produce different output file formats *(e.g. jpg, png…)*. - The "Display"-settings define, which of the different UI-layers *(measurements, shapes, overlays, crosshairs)* are visible on the screen. - The "Save" button saves all settings/changes made permanently to disk. ⚠ Only the layers visible on the screen *(i.e. the layers activated)* will be considered for screenshot /recording!

4.2.8 Snapshots

Part of the camera image can be captured as a snapshot. Snapshots are created by selecting "Take Snapshot" from the context menu. Once an area of the camera is selected it can be optionally adjusted, accepted or discarded. Snapshot area can be resized from its corners. Snapshots are stored in its own layer which can be hidden or shown in the Display settings. Rotation and opacity can be adjusted from the slider which are visible when a snapshot is selected. Snapshots can be saved or deleted from the snapshot context menu (opens with right mouse click on the snapshot).

Rotation angle can be adjusted with a 0.1° precision with left (←) and right (→) arrow keys when the slider is focused.
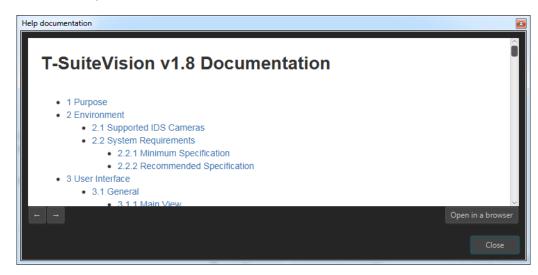
4.2.8.1 Snapshot Context Menu

Menu	MenuItem	Description
	Save	Saves currently selected snapshot to a file
	Delete	Deletes currently selected snaphot
	Delete All	Deletes all snapshots
	Set as default opacity	Set the selected snapshots opacity as the default opacity for new snapshots

5 Troubleshooting

5.1.1 Help

Opened by clicking on the respective T-Settings button. The help content can be viewed in the application itself or in a browser *(by pressing "Open in browser" button)*.

> ⚠ If you want to view the documentation without starting T-Suite Vision, please refer to the PDF- and HTML-shortcuts which are contained in the T-Suite Vision installation directory.

5.1.2 About Dialog

Provides some additional information like the application version number, disclaimers and other.

Log export

The application logs can be exported to a user-defined location. Choose the function "**Export Logs**" to copy all currently available logfiles to a destination of your choice.
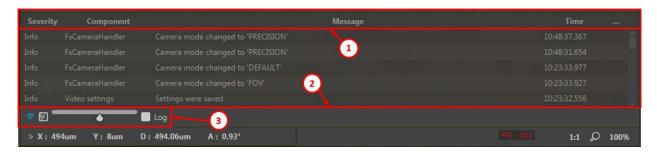
For more information about application logging, check out the sections below.

> ⚠ Note that the "Export" function copies ALL logfiles to the chosen destination. If you plan to send them to Tresky support for investigation, please make sure to send only the relevant/recent ones *(remove/skip the nonrelevant ones)*.

5.1.3 Logs

Relevant info-, warning- and error-messages of the TSuite Vision application are logged to the Log View.

1	Log View header containing the different log columns.
	✓ Usually, the log entries are automatically sorted by the timestamp of their occurence. However, the sorting can be changed by clicking on one of *(header)* columns. A 2nd click on the same column switches from ascending to descending order and vice versa.
2	Log message list.
3	Controls for expanding/collapsing and changing the opacity of the Log View.

⚠ It is important to note that, <u>the log view on the user interface does NOT contain all log entries made within the application</u>. It shows mainly user-relevant information. The full list of log entries is only contained in the application logfiles. For doing a reasonable investigation/analysis in case of malfunctions and other problems, it is essential for the Tresky support to receive the relevant application logs.

The application logs contain all the information needed to do reasonable investigation/analysis in case of malfunctions and other problems. The application logs are implemented as "rolling files" which means **a new log file with the name "tsuitevision.log" is created on each application start**. At the same time *(i.e. when a new logfile is created)*, the old/former application log files are renamed, accordingly:
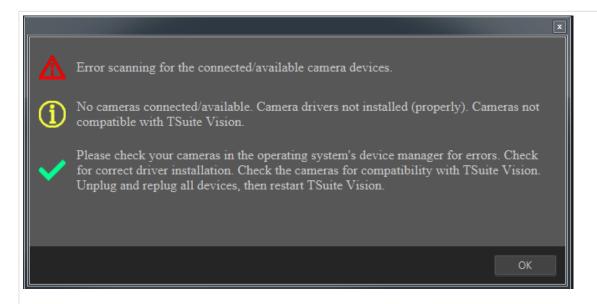

There is no need to search for the logfiles because TSuite Vision has a built-in functionality to export the files to a user-defined location. For more information, check out the sections of the "About Dialog" and the "Log View".

5.1.4 ECS

TSuite Vision incorporates the so-called "Error-Cause-Solution" (ECS) concept as a feature to support troubleshooting in case of problems.

Certain messages *(warnings, errors)* are presented in the Log View with an additional **ECS-icon** *(marked green in the picture to the left)*. The icon indicates, that **the given log entry contains additional information**. A single click on the icon opens up a dialog with the respective information *(see the picture below)*.

The ECS information is structured into three distinct sections:

Symbol	Section	Description
⚠	Error	Gives a rough description of the issue/problem.
ⓘ	Cause	If available, this section gives an overview of any possible causes of the problem.
✓	Solution	If available, this section gives hints as how to overcome/workaround the problem.